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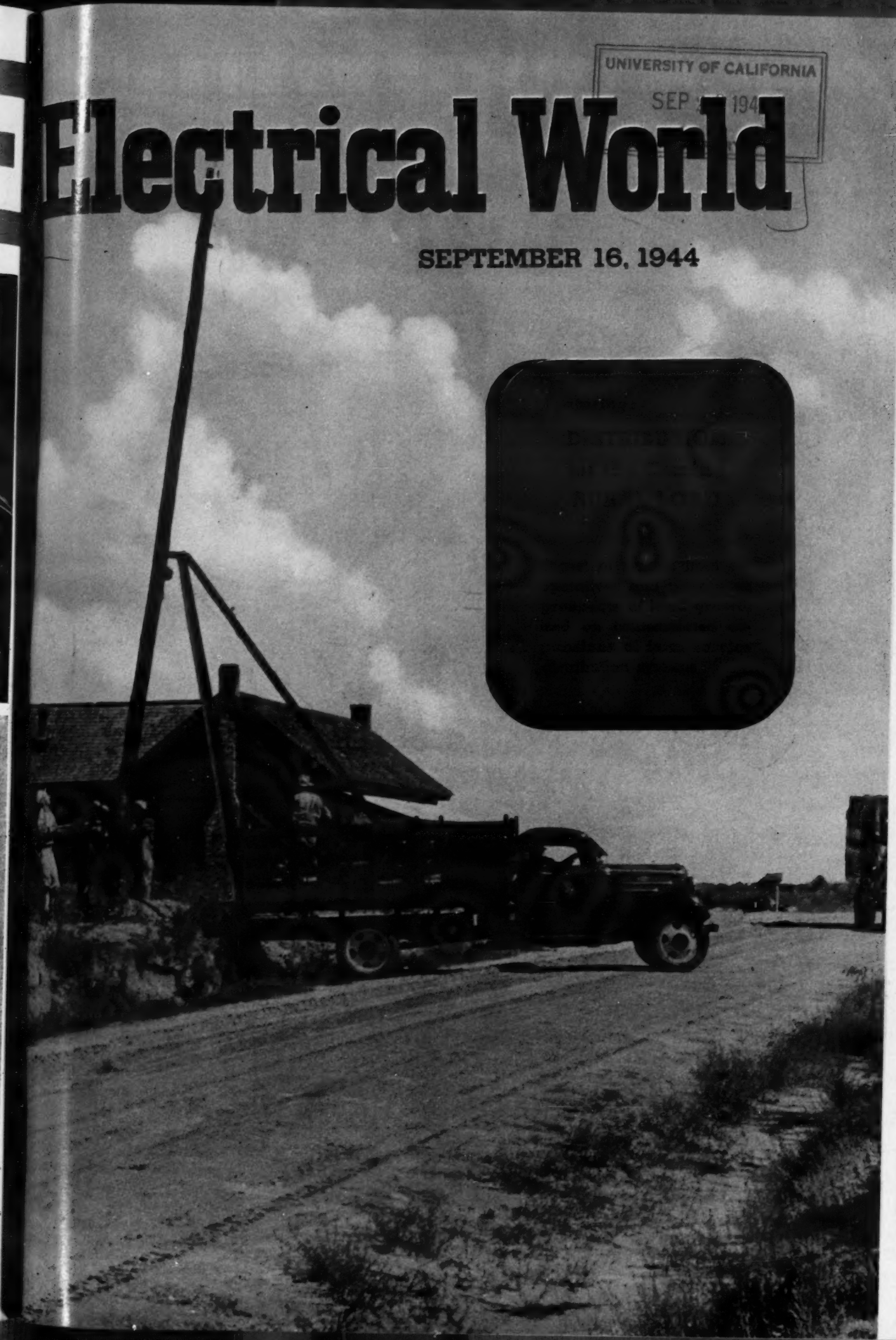
SEP 194

Electrical World

SEPTEMBER 16, 1944



Still the SPEARHEAD

in the drive for BETTER LIGHT-BETTER SIGHT

A decade ago, the WESTON Illumination Meter was the basis for the original Better Light — Better Sight campaign. Its development made possible, for the first time, the measurement of illumination efficiency in terms that were scientific, constant, and readily understood.

And today, a WESTON Illumination Meter, *but of an advanced* type, still spearheads the crusade. Equipped with the exclusive WESTON VISCOR filter it provides direct measurement of light of any type or color composition, without correction factors. Whether you measure daylight, neon, incandescent or fluorescent, you get a direct, accurate measurement with Viscor filtered WESTON Illumination Meters.

Thus in light measurement, too, WESTON's pioneering achievements are only mile-posts in an endless, upward march. The engineering skill that fathers them keeps pace with progress . . . *Keeps constantly leading the way.* Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON

DIRECT-READING

Illumination Meters

Model 703 Sightmeter—equipped with the stable WESTON VISCOR filter...

Model 603 WESTON Illumination Meter (VISCOR filtered)

Model 614 WESTON Illumination Meter (VISCOR filtered)

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters...Aircraft Instruments... Electric Tachometers...Dial Thermometers.

FOR OVER 35 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 70 YEARS

September 16, 1944 — Vol. 122, No. 12

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Let HAZARD EXPERIENC

. . . help you pick the RIGHT electrical cabl

Today there's *less* wire — but *more* variety!

With synthetics now necessarily being used in place of rubber, you're probably confronted with a multitude of unfamiliar wires and cables. Yet Hazard engineers quickly can steer you through this maze to the selection of the proper cable for any installation. And the cables they recommend won't be untested substitutes, hastily developed to meet the wartime emergency.

Our study of synthetic insulating and sheathing materials was started *13 years before this war began.* Many of these were developed to supply specific properties (such as resistance to hea flame, oil, chemicals, etc.) which could not be o tained with conventional materials. Now, throug continuing research, these *tested* and *proved* pro ucts — further developed and augmented by othe — are ready to help keep vital electrical syste functioning at their usual efficiency.

Whatever your particular need, Hazard exper ence can be your most helpful guide the next tim you're specifying electrical wires and cable Hazard Insulated Wire Works, Division of Th Okonite Company, Wilkes-Barre, Pa.

3508

HAZARD

Electrical Wires and Cables

LITTLE DID WE KNOW, these 12 years while we were saying, "Electroline Automatic Line Splices are reclaimable" that the really big story had not yet been told.

Now this important reclaimable feature scores again. Vital materials from which Automatic Line Splices are made are mostly off to war . . . so it is impossible to supply the quantity of line splices we would like to but your stock bins will supply splices for immediate requirements.

Every "out of service" line equipped with Electroline Automatic Line Splices is a source of supply. These splices are reclaimable.

Electroline Splices can be removed in a jiffy. Back they go to stock bins for re-use . . . time and time again. Stock without stock expenditures. How's that for an "extra" dividend?

It is the everlasting quality of Electroline products that assures our users of adequate, effective usable Automatic Line Splices for the duration. The quality is there because long experience in this field has taught us how to put it there. Not only the first Automatic Line Splice, but also the first Reclaimable Line Splice came from the house of Electroline.

Electroline Company

Originators and Patentees of Automatic Line Splices and Dead Ends

4121 SOUTH LA SALLE STREET • CHICAGO 9, ILLINOIS

CRAFTSMANSHIP COUNTS!

THIS huge Elliott motor stator and frame is destined for the main propulsion drive of a Maritime Commission vessel.

It is a nice job of motor building. The fabricated frame is exceptionally rigid. Form-wound coils made of transposed strands improve efficiency and reduce heating. The coils are insulated with mica tape and impregnated with a special insulating compound. These coils form a single turn series wave winding, with all connections at one end. This arrangement provides for easy emergency repair should it be necessary, as a damaged coil can be cut out of the circuit by opening the connections and inserting jumpers.

This motor develops 6600 hp. at 93 r.p.m. Its size is a measure of Elliott engineering capacity. Its craftsmanship is characteristic of all Elliott motors, large and small.

When you need a quality motor, come to Elliott.

OTHER PRODUCTS:

STEAM TURBINES • GENERATORS MOTORS • CONDENSERS • FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS • CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES • TUBE CLEANERS STRAINERS • DESUPERHEATERS • FILTERS

ELLIOTT *Company*

Electric Power Dept.

RIDGWAY, PA.

DISTRICT OFFICES IN PRINCIPAL CITIES

E-752

CHECK the FACTS

UNITS STACKED FOR INSPECTION AND EXPORT SHIPMENTS

1. Maximum strength to withstand mechanical stress and electric shock.
2. Shrink-fit assembly, of preheated hardware and unsanded porcelain with special alloy, provides vibration-proof bond.
3. Resilient construction eliminates spot loading.
4. Jig-set assembly provides interchangeability.

Built in all sizes and capacities on any NEMA standard porcelain. Interchangeable for wall mounting or switch base construction.

R&IE BACK CONNECTED POST

The Check List

DISCONNECTING SWITCHES
INDOOR AND OUTDOOR

✔

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

•

AIR BREAK SWITCHES

•

INTERRUPTER SWITCHES

•

CUTOUTS AND THERMO-RUPTERS

•

SWITCH OPERATING MECHANISMS

•

SUBSTATIONS

•

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

•

KIRK INTERLOCK SYSTEMS

•

AUTOMATIC SECTIONALIZING EQUIPMENT

•

METAL CUBICLES

•

TESTING DEVICES

AILWAY AND INDUSTRIAL ENGINEERING CO. GREENSBURG, PA.
IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

X MARKS THE REASON

FOR THE CONSISTENT GOODNESS OF O-B TRANSMISSION LINE HARDWARE

"X marks the spot" where O-B transmission line hardware come from. In the electrical porcelain industry, O-B is the only supplier of insulator hardware that owns and operates 100 per cent of its metal fabricating facilities--all the way down to production of the basic metals, themselves, in efficient, specialized, highly controlled foundries... O-B hardware designers are beholden to no one material. They have free call on malleable iron, bronze, aluminum, or steel forging. Selection is based wholly on suitability for the job at hand, and on practical production considerations... By eliminating the need for manufacturing compromises, you, as a user of O-B insulation hardware, are greatly benefited. Every piece is designed theoretically right, from the ground up. O-B engineers don't have to start with anything but a good idea--the facilities are available to interpret this idea to best advantage... This is part of the reason why O-B hardware is making fine service records; and at least part of the reason why you should specify O-B on your next job.

2490-H

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LIMITED

NIAGARA FALLS, ONTARIO

Bz-z-z.. off goes Trouble!

A SOLID STRUCTURE such as a motor shaft rarely fails from the inside out—it fails from the outside in. Moral: get rid of every surface tool mark or irregularity that might someday invite cleavage.

That's what Stan Brothers, above, of Allis-Chalmers Norwood Works is doing. As he painstakingly polishes the shaft—back and forth, back and forth—he works down to a finish that's slicker than silk.

Why does he follow his job so intently? Because in 17 years at Allis-Chalmers Stan has learned that he and every other employe has a *personal* stake in every motor.

He knows that when he helps build a *great* motor for you he helps make a *friend* . . . and that friends are something no company and its workers can have too many of.

Actually, it was friends that put Allis-Chalmers importantly in the motor business in the first place.

Years ago, Allis-Chalmers began building motors only because it wanted, to put on heavy-duty equipment it built, better motors than it could buy. Then a few of those motors were sold separately to one customer, a few to others . . .

And the reputation those motors earned—"You can depend on Allis-Chalmers Motors"—literally forced Allis-Chalmers into building electric motors in volume for the market!

So the very existence of Norwood Works is proof and reminder to every Allis-Chalmers coil winder, machinist, inspector, welder, brazer, painter, assembler—that *good work catches up with a company just as surely as bad work.*

That's why you can expect *good* work in every Allis-Chalmers motor! Allis-Chalmers, Milwaukee 1, Wis.

A 1728

YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS

New Ampac A-C WELDER Makes Big Hit!

SUPERINTENDENTS LIKE AMPAC BECAUSE:

- They get a wider operating range with the Allis-Chalmers Ampac "400"—50 to 500 amps. That means they can schedule a greater variety of welding output on both *thick* and *thin* metals without changing machines.
- They don't have to provide a 3-phase line when they install Ampac — as they do with d-c welders. Ampac uses *any* standard a-c voltage: 220-440 and 208 v, 60 cycle.
- Ampac's lower initial investment makes sense to them. Its simplified construction and quick installation produce a big saving over comparable d-c units.
- They like Ampac's low maintenance. Ampac welders need only a 15 minute inspection and lubrication twice a year. Less time *out* for service—more time *in* for production.
- Ampac's simplicity means longer life, more dependable service. There are only three moving parts to wear.
- Power bills are reduced by as much as 50% after switching from d-c welders to Ampac.

WELDERS LIKE AMPAC BECAUSE:

- They don't have to fight arc blow . . . there's *none* with an Ampac a-c welder!
- They do better work — get sound, uniform welds with Ampac's steady power flow. That also means they can weld in deepest corners without reducing speed.
- They like the easy, quick way they can adjust Ampac power. Seven turns of the control wheel covers the entire welding range.
- They find Ampac easier to move over rough floors. Wheels available are *oversize.*
- Any accidental damage to Ampac's case does *not* affect the structure of electrical parts within. Case serves only as a protective shell.
- They know they can stay on a job until it's done . . . because Ampac's oversize, extra-rugged parts can take it. The new Ampac was designed in wartime for 24-hour-a-day war production.
- Get the full story on this brilliant new welder from our nearby Ampac dealer or A-C District Office. Allis-Chalmers, Milwaukee 1, Wis.

♪ *Tune in the Boston Symphony, Blue Network, every Saturday at 8:30 pm, EWT.*

ALLIS-CHALMERS AMPAC "400"

A 1702

Sangamo Capacitors Can Take It!

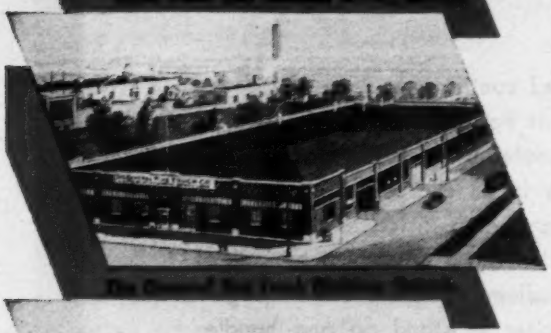
Sangamo Type A capacitors have been manufactured continuously since 1925. As the first mica capacitor to be moulded in bakelite, it has been incorporated into the designs of many transmitters and receivers. Designated under the War Standard as Case Styles GM55 and 60, this unit is available in all characteristics from B through F and in the entire range of voltages and capacities listed in these standards. While comparatively small in physical size, the "Type A" has been called upon to do an exceedingly big job in low-powered, medium, and quite often in high-powered transmitters, where the ability of a capacitor to stand up and handle comparatively large amounts of RF current is of paramount importance. The continued application of the Type A capacitor in these transmitters is adequate proof of its ability to meet these requirements. Manufactured under War Standard specifications calling for severe immersion tests, extreme temperature ranges, definite retrace or drift characteristics, this capacitor is an outstanding example of the advanced enginering design and manufacture inherent in the entire line of Sangamo Mica Capacitors.

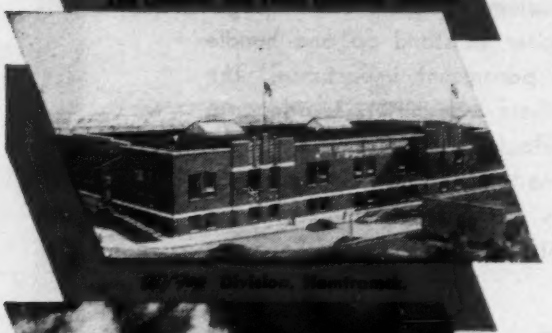
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

BEHIND THIS DOOR

Stands 40 Years of FIRE PROTECTIONEERING





In war and in peace, for more than forty years, buyers of fire protection equipment have learned to say "if it's General Detroit it's dependable."

This is because the men and women of General Detroit, from top management to production line, are *fire protectioneers.* Their skill and extensive plant facilities enable them to produce fire extinguishers and fire fighting apparatus that are *engineered* to do the job of fighting fire quickly, safely, and economically.

Leaders of American industry who have bought and used General Detroit products know by actual experience what this means. The engineering research and proven production capacity of this forty year old firm are at your service in the fight to reduce and eventually eliminate the menace of fire loss.

Victory over fire is important too!

IF IT'S GENERAL IT'S DEPENDABLE

THE GENERAL DETROIT CORP.

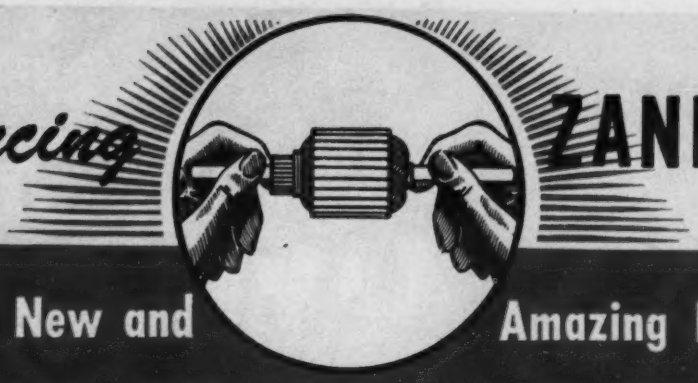
2270 E. JEFFERSON AVE., DETROIT 7, MICH.

CHICAGO *Distributors in all principal cities* **NEW YORK**

West Coast Affiliate: The General Pacific Corp.

Seattle • LOS ANGELES • San Francisco

Announcing ZANDEROLL*



A Process* of New and Amazing Efficiency for INSULATING ARMATURES AND STATORS

Proven and Guaranteed ADVANTAGES

- ✓ Reduces total treatment time 50% to 90%.
- ✓ Eliminates the costly job of removing unwanted varnish from armature shafts.
- ✓ Eliminates all drainage of varnish after removal of armature from bath. No cleaning of drainboards and oven floors. Less fire hazard.
- ✓ Completely penetrates throughout armature windings. Distribution of varnish is so uniform that armatures balanced before Zanderizing* are in balance after treatment.
- ✓ Thorough and complete bake of varnish insulation assured in less than half the time required by other methods.
- ✓ Improves appearance of finished product.
- ✓ Substantially reduces floor space requirements.
- ✓ Maintains uniformity of production by simple controls and ease of inspection.

See and Inspect A TEST TREATMENT OF YOUR PRODUCT

A pilot plant now in operation provides facilities for test treating armatures and stators up to 5-inch diameter. Manufacturers are invited to view the Zanderoll Process* and have their products test treated. Full cooperation is offered to your engineers to determine and analyze the amazing benefits of the Process* as applied to your particular requirements.

Complete ENGINEERING SERVICE

Through Fostoria Industrial Service Centers, located in twenty major cities, The Fostoria Pressed Steel Corporation, under licenses issued by The Sterling Varnish Company, and in cooperation with Sterling engineers, provides adequate facilities and highly trained engineers particularly qualified to specify and supply necessary equipment and insure proper utilization of the Zanderoll Process*.

Patents Applied For

For further information and an appointment to inspect the Zanderoll Process* and have your products analyzed and test treated, write, wire or phone—

THE STERLING VARNISH COMPANY • Haysville, Penna.
or THE FOSTORIA PRESSED STEEL CORP. • Fostoria, Ohio

Actual photo of a Gulf Service Engineer (right) consulting with municipal power plant operating Superintendent on Diesel engine lubrication.

"We've had 18 years of dependable low-cost service from this Diesel with Gulf Parvis Oil —

says this Superintendent

no operating troubles, no repairs to lubricated parts"

IT sure has paid us to use a quality Diesel lubricant," says this Superintendent. "With Gulf Parvis Oil we've had dependable low-cost service from this unit since it was installed in 1926—no operating troubles, and no repairs to lubricated parts."

To help keep your Diesels delivering maximum kw.-hrs. at minimum cost for maintenance, take a tip from this and many other power plants that report better lubrication with Gulf Parvis Oil.

Gulf Parvis Oil provides greater protection for hard-to-replace parts—helps prevent excessive wear that leads to shutdowns, below-par operating efficiency, and high maintenance costs. Gulf Parvis Oil offers you proven performance and long life!

Call in a Gulf Lubrication Service Engineer today and ask him to recommend the proper grade of Gulf Parvis Oil to fit your particular requirements. Write, wire, or phone your nearest Gulf office.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company · Gulf Building, Pittsburgh 30, Pa.

● **Amerclad Type S** is a heavy-duty portable cord for electrical tools and similar applications where the cord is subject to extremely rough usage. *Type SJ*, having a lighter jacket, is designed for use in homes, stores and offices.

● **Amerclad Welding (Electrode-Holder) Cables** feature extreme flexibility and light weight combined with typical Amerclad toughness. They are easy to manipulate, lie flat and can be moved without kinking or snarling.

AMERCLAD

. . . a bear for punishment
. . . a beaver for work

EVER notable for long life, Amerclad Cords and Cables are built tough to stand the hard knocks of wartime speed-up. Light, flexible and easy to handle, they can be pulled through puddles, dragged over rough ground, subjected to abrasive wear, or exposed to severe chemical action. Yet they keep right on delivering an uninterrupted flow of power. Their stamina is built in.

Even now, when crude rubber is not available and the use of Neoprene is greatly restricted, we have developed synthetic rubber compounds for use in Amerclad Cords and Cables to carry on the old tradition of trouble-free service.

Here's an invitation. Pick out your toughest portable cable job. Next time that cable needs replacement, use Amerclad. You should have the benefit of the time- and money-savings that Amerclad insures.

Building Wire — Rubber or Synthetic resin insulation
Non-Metallic Sheathed Cable
Service Entrance and Drop Cable
Power Cables — Rubber, Varnished Cambric or Paper Insulation
Armored Submarine or Parkway Cables
Non-Metallic Parkway Cables
Rubber-sheathed Cords and Cables
Heat-proof Asbestos Insulated Cables
Weatherproof and Annunciator Wire
Magnet Wire of all types and sizes
Galvanized Steel Wire and Strand
Rural Distribution Conductors.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

USS

UNITED STATES STEEL

Which of these 16 selling points are strongest . . . for this prospect?

Frigidaire Research proves there is a basic relationship between how a salesman handles the 16 Selling Points listed below and how fast, how surely he closes a sale. So all these factors are important—but which are *most* important with different prospects? When he launches his post-war selling drives, the Frigidaire Dealer and his salesmen will have the answers to hundreds of questions like this—in practical and usable form, through sales training based *solidly* on Frigidaire Research.

HOW DO YOU VOTE? Look over the following 16 Selling Points. Check the ones you believe most effective *with the type of prospect described above.*

- ☐ Mechanical features
- ☐ Appearance features
- ☐ Convenience features
- ☐ Service the appliance provides
- ☐ Quality of product
- ☐ Cost of operation
- ☐ Price ☐ Terms
- ☐ Brand name
- ☐ Experience of manufacturer
- ☐ Reputation of manufacturer
- ☐ Reputation of dealer
- ☐ Location of dealer
- ☐ Local service facilities
- ☐ Prospect's past experience
- ☐ Recommendations of others

IF A QUIZ LIKE THIS provides a few minutes' mental exercise, perhaps it doesn't really matter how correct your answers are.

But when making sales or missing them depends on knowing which selling points are most effective with which prospects, or on knowing which new features will be "musts" in postwar appliances—then it's essential to have *all* the answers. And that's the kind of thinking that sparks Frigidaire's Customer Research Staff.

What do housewives consider the most important advantage of electric cooking? What are the strongest selling arguments for electric ranges?

What is the opinion of typical housewives on table-top ranges vs. the "high-oven" type? On table-top vs. standard-height refrigerators?

How many families out of every 100 intend to buy a: Home freezer? Combination refrigerator and freezer? Conventional refrigerator?

Just how important is user follow-up, and what method produces the most leads for other sales?

How do refrigerator buyers go about choosing the dealer from whom they make their purchase? How can more such prospects be induced to visit the Frigidaire Dealer first?

These are only a few of the hundreds of questions on which Frigidaire Dealers will have the answers. Answers to questions of product design...of merchandising. *Answers which will mean so much to them as refrigerators, ranges, water heaters, air conditioners, and other major appliances come back on the market.*

In addition . . . through surveys within its own dealer organization, Frigidaire finds the answers to innumerable specific questions—answers which not only help Frigidaire plan its production, but also provide information which may be passed along to *all* Frigidaire Dealers, *enabling each Frigidaire Dealer to benefit from the experience and thinking of his fellow dealers.*

Over a Half-Million Consumer Research Contacts

In the past nine years alone, Frigidaire Research has conducted 77 major consumer studies—has queried close to 625,000 persons. This is *besides* the information continually being gathered from Frigidaire Dealers, *for other Frigidaire Dealers!*

Research like this among consumers and dealers is just one of the things that make the Frigidaire franchise so valuable. Such research has been going on at Frigidaire for years, will continue to have its profound effect on *what* Frigidaire dealers sell their customers—on *how* they sell them—on *how much* they sell them. As a division of General Motors, Frigidaire shares in its great tradition of . . .

"Finding out what people LIKE —and doing MORE of it.

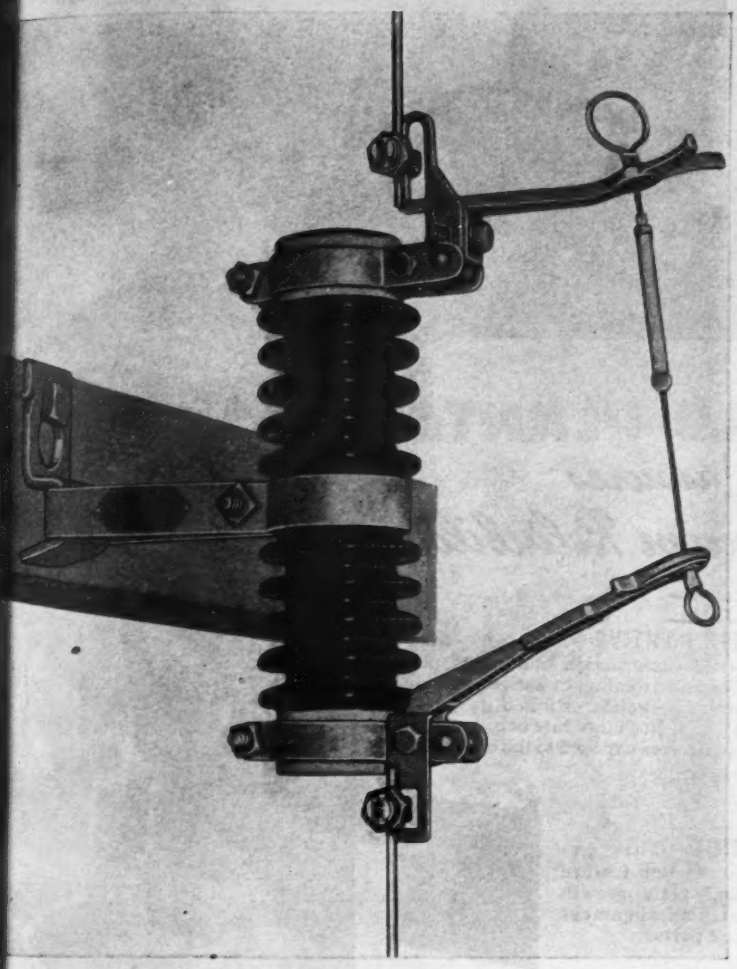
"Finding out what they DON'T LIKE —and doing LESS of it."

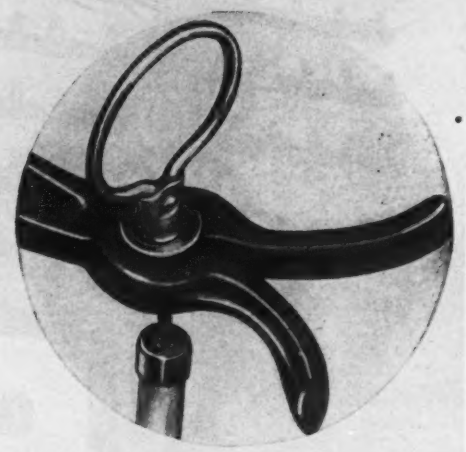
Listen to the
GENERAL MOTORS SYMPHONY OF THE AIR
Every Sunday Afternoon, NBC Network

For Excellence in War Production

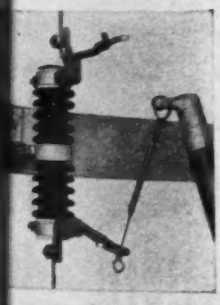
FRIGIDAIRE
Division of
GENERAL MOTORS
Dayton 1, Ohio Leaside 12, Ontario
Pioneering builders of
ELECTRIC REFRIGERATORS • RANGES • WATER HEATERS
HOME FREEZERS • ICE CREAM CABINETS
COMMERCIAL REFRIGERATION • AIR CONDITIONERS
BEVERAGE, MILK, AND WATER COOLERS

STURDY–LOW COST MATTHEWS PROTECTOLINK CUTOUTS





Catalog 1640-50 Amp. 7.5/12.5 KV. Grd. Y — Catalog 1641-50 Amp. 15 KV.



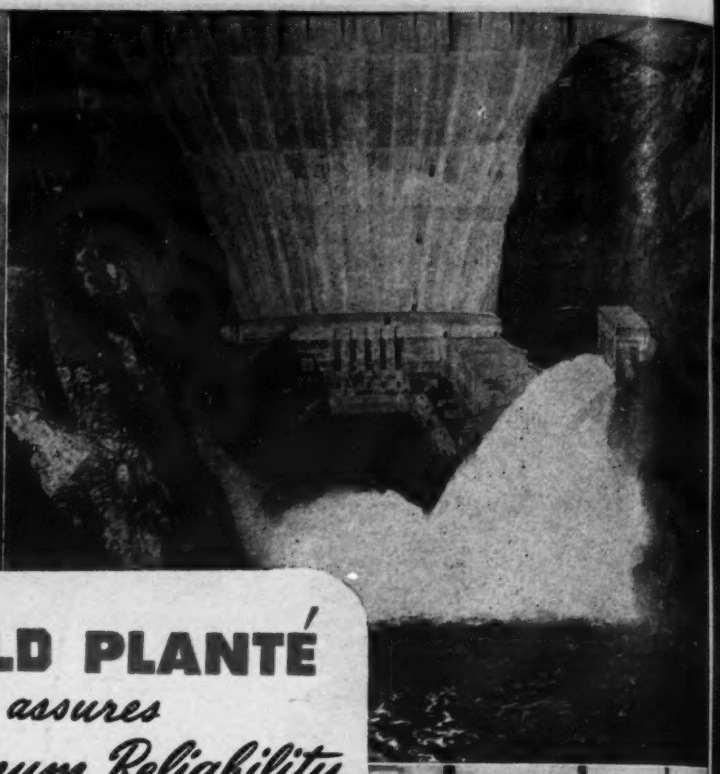
Write for Bulletin 101-A

The design and ruggedness of Matthews Protectolink Cutouts and Protectolinks insures better performance and lower maintenance costs.

Because of the rigid construction of the contact arms they cannot be easily bent out of alignment when fusing or installing the cutout and the fact that the lower arm is actuated by an individual spring, assures positive contact tension on the Matthews Protectolink.

Note design of the contact ends of the arms. They provide easy installation and automatic seating of Protectolink buttons into the cup shaped contact recesses. No wedging of fuse link into contacts is required, thereby preventing damage to fine wires of fuse link cable. Matthews Protectolink Cutouts will also accommodate any make of open link fuse, and Matthews Protectolink Fuse Links fit other makes of open link cutouts.

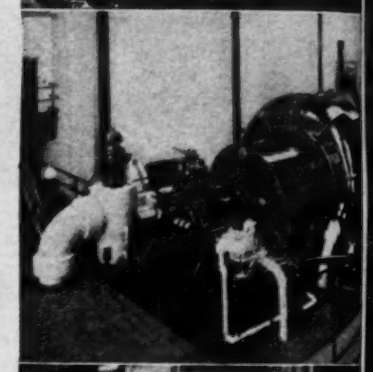
W. N. MATTHEWS CORPORATION
SAINT LOUIS, U. S. A.
ENGINEERS and MANUFACTURERS SINCE 1899

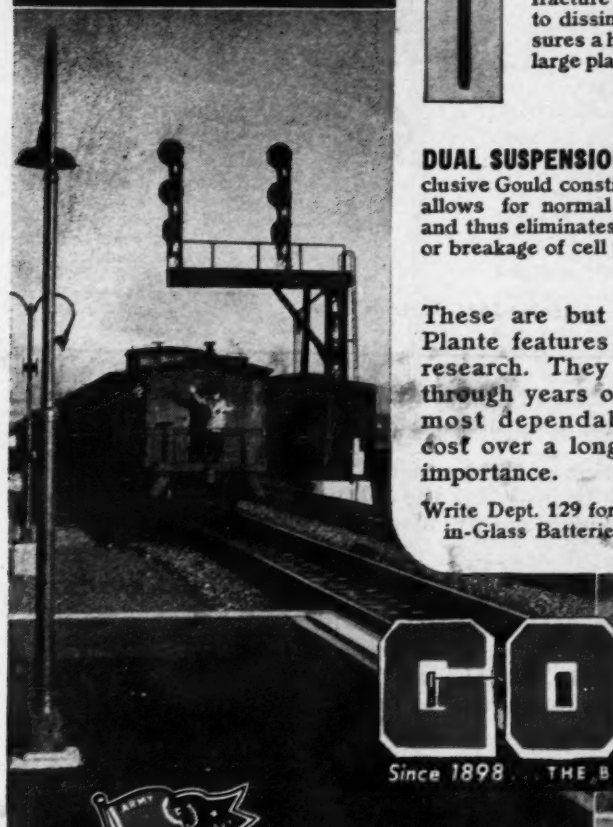


GOULD PLANTÉ
assures
Maximum Reliability

PLANTE POSITIVE—This one-piece pure lead construction eliminates plate fracture and isolation of active parts due to dissimilar metals. Ribbed design assures a high discharge rate because of the large plate area exposed to the electrolyte.

DUAL SUSPENSION—This exclusive Gould construction feature allows for normal plate growth and thus eliminates misalignment or breakage of cell parts.





These are but two of the many Gould Plante features developed through Gould research. They have proved themselves through years of actual service where utmost dependability and low operating cost over a long period are of paramount importance.

Write Dept. 129 for Bulletin 1000 on Gould Sealed-in-Glass Batteries for Stationary Applications.

GOULD

Since 1898 . . . THE BATTERY PICKED BY ENGINEERS

For Excellence in storage battery production at Depew plant

GOULD STORAGE BATTERY CORPORATION, Depew, New York. Factories: Atlanta • Chicago • Dallas • Depew • Leavenworth
Los Angeles • North Bergen • Rock Island • St. Paul • Sioux City • Zanesville

STYLE "B"
with gasketed flange for mounting on boxes.

...e years of trouble-free service has ...ed a wide acceptance of G & W Type "FC" Oil Fuse Cutouts. The modern design ...rovides interchangeability of parts for ...rious installation conditions. The ...king cover and cover clamp insures ...ety in fuse replacement. The simple and ...xpensive fuse link universally fits all ...ype "FC" cutouts.

½ cycle interruption of short circuits pro...cts equipment.

Beryllium copper springs make ideal full ...d break switching contacts.

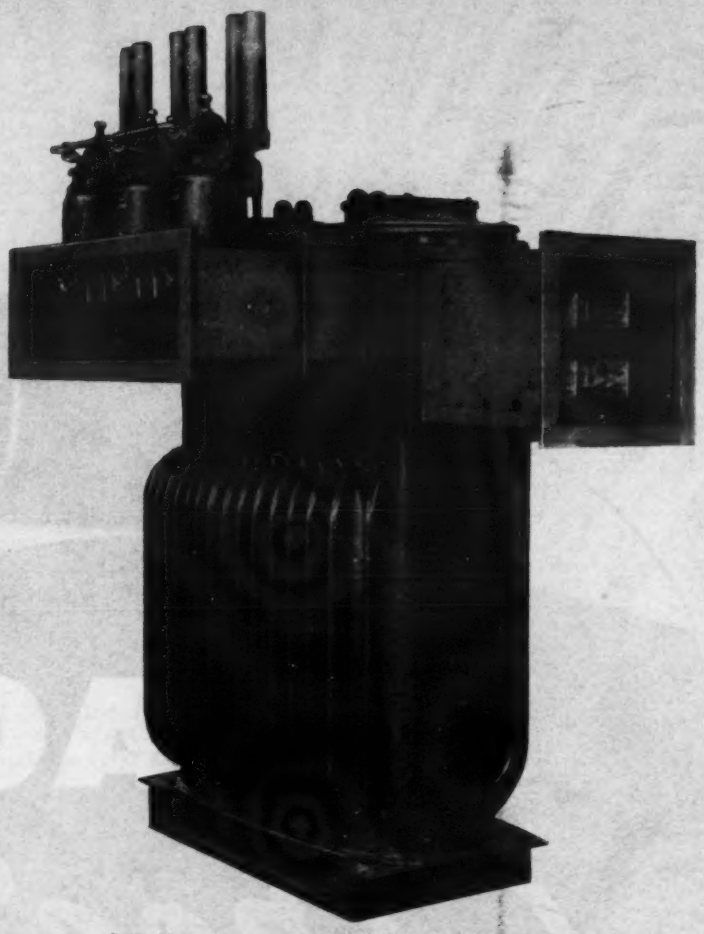
Save Installation Labor

By Specifying

G & W TYPE "FC" OIL FUSE CUTOUTS

on your transformers

FULL COOPERATION WITH TRANSFORMER MANUFACTURERS IS ASSURED



300 Kva. unit substation type transformer manufactured by Pennsylvania Transformer Co. Equipped with G & W No. FC42B oil fuse cutouts.

Secure the advantages of complete unit metal enclosed construction with CUT-OUT BOX attached to the transformer.

Installation labor is reduced by merely terminating the feed cables in potheads (*also made by G & W*) or within the cut-out insulators inside the box. Conduit connections can be made on the pothead or directly on the box.

An economical primary load-break oil switch with overload and short circuit fuse protection.

Send for Bulletin 425

G & W ELECTRIC SPECIALTY CO.

7780 DANTE AVENUE • CHICAGO 19, ILL., U. S. A.

In Canada—Powerlite Devices, Ltd., Toronto

GANG OPERATED } **FOR FUSING AND SWITCHING PRIMARY CIRCUITS SUBWAY – OVERHEAD – VAULTS**

ANNOUNCING*

SPRAGUE

Ceroc200

A high-temperature (200° C.) ceramic insulation for copper, nickel, and other wire

*We use the word "Announcing" advisedly. Although this is its first public announcement, Sprague CEROC 200 is by no means a new or untried development. Many engineers are already familiar with it. Many have long been using it on restricted war developments on which details cannot yet be announced. So far-reaching are its possibilities for such a wide variety of electrical products, however, and with our production facilities being steadily and materially expanded we take this means of bringing it to general trade attention.

† T. M. REG. U. S. PAT. OFF.

CEROC 200

INORGANIC INSULATION FOR COPPER AND OTHER WIRE

ERMITS 200° C. CONTINUOUS OPERATION

FOR MANY TYPES OF ELECTRICAL EQUIPMENT

CLASS C INSULATION MATERIAL

SS SECTION
e extreme
iformity of
ROC 200
kes for
ooth, level
nding. The
nness with
ch it may be
osited on the
saves space.

Culminating seven years of continuous research and development by the Sprague engineering organization, CEROC 200 now paves the way for greatly increased efficiency, smaller sizes, and lighter weight for a wide variety of electrical equipment.

Sprague CEROC 200 is a ceramic norganic) insulating coating thinly deosited on copper, nickel, and other es of wire, and permitting much gher continuous operating tempera-es than are possible with ordinary ass A insulations such as enamels, varhes, and other organic materials. pplied to copper wire, it permits of a nservatively rated 200° C. continuous erating temperature as compared to present limit of 105° C. for Class A terials. Thus, by designing electrical uipment to utilize the full maximum erating temperature of this new wire ating, a very substantial increase in lt-ampere rating can be obtained. We lieve that CEROC 200 meets all requies of a Class C insulating material der A. I. E. E. standards.

ERMAL CONDUCTIVITY: Coils wound th CEROC 200 dissipate heat rapidly. ere is little or no tendency toward velopment of hot spots which might illify a big percentage of the high-mperature gain that would otherwise expected. Thus, the high-temperature vantages of CEROC 200 are real and t apparent.

SPACE FACTOR is extremely good. Typical percentages of copper area to total cross-sectional area of finished wire are 96% for AWG #21 wire, and 95% for #24 wire for CEROC 200 by comparison with only 69% and 59% respectively for other insulations that might be used for high-temperature applications. Moreover, CEROC 200 coating is extremely uniform, thus making for smooth, level winding. The preferred coating thickness is ¼ mil., and the following characteristics are based on wire so coated:

MAXIMUM STABLE TEMPERATURE for continuous operation—200° C.

VOLTAGE BREAKDOWN between two wires of a twisted pair 4" long:

Standard condition (25° C.)—300 v. A.C.

Humid condition (95% relative humidity)—300 v. A.C.

Hot condition (200° C.)—300 v. A.C.

LEAKAGE between two wires of a twisted pair, 4" long, at 95% relative humidity is greater than 100,000 megohms.

FLEXIBILITY by bending: 16% elongation.

ABRASION RESISTANCE: Average 16-18 scrapes at 200 G. weight on G.E. abrasion tester for #25 AWG wire having the preferred ¼ mil. coating thickness. On wire sizes smaller than #25, this average is slightly less, and on larger than #25 wire, it is somewhat more.

WIRE SIZES: Although CEROC 200 is constantly being adapted to new uses, the present preferred ranges for coated wire are as follows:

Copper wire—from 3 to 30 mils (#40 to #21 AWG).

Nickel wire—from 1½ to 12 mils (#46 to #28 AWG).

WINDING CHARACTERISTICS: CEROC 200 is sufficiently flexible to present no winding difficulties that will not be far more than compensated for by its tremendous high temperature and space advantages. In general, round coils can be wound satisfactorily by existing methods. Slight modifications in winding technique may prove necessary, however, in the case of rectangular coils or motor armatures.

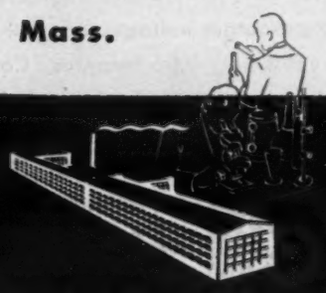
Although costs on CEROC 200 are being steadily revised downward, as a result of greatly increased facilities, it should be borne in mind that this material was not designed to compete on applications where conventional organic insulations are giving satisfactory service. Rather, it is intended for those applications where a substantially higher temperature insulation combined with space- and weight-saving factors more than justify a somewhat higher price for the CEROC 200 insulation that makes them possible.

SAMPLES

CEROC 200 is by no means a new or untried development. For more than a year, large quantities of CEROC-insulated wire have been supplied for important war applications of the most exacting sort. Thus, although production facilities are being steadily increased, it is still difficult to supply generous samples of specific wire sizes to all who might be interested. As far as possible, however, we will gladly supply small quantities of available sizes to large users who want to test its far-reaching possibilities in connection with their products at a later date when full and prompt deliveries are possible.

SPRAGUE ELECTRIC COMPANY, North Adams, Mass.

(Formerly Sprague Specialties Company)



SPRAGUE

CAPACITORS • KOOLOHM RESISTORS • CEROC INSULATION

†TRADEMARKS REGISTERED U. S. PATENT OFFICE

This *NEW* Sturdy, Smaller Transtat AC Voltage Regulator OFFERS INCREASED DESIGN POSSIBILITIES!

The new TH 2½A Transtat A. C. Voltage Regulator is half the size and less than half the weight of the smallest previous TH Transtat. When used as a dual unit, a further space saving is made possible by base-to-base mounting. In attaining this extreme compactness, AmerTran also introduced several mechanical innovations: the unique die cast brush arm with its generous heat dissipating surface; smooth commutator with solid insulation between segments; the operating shaft that can be quickly changed for table, panel or gang mounting; the Phenolic Thermosetting Plastic Base with its terminal barriers and other features.

Yet the TH-2½A Transtat's conservative rating is a working rating—output voltages are full load voltages. Exciting current is only 0.06 amperes. Control throughout working range never exceeds 0.4 volt increments. And like its larger brothers, it cannot disturb power factor, distort wave form or interfere with radio reception. Investigate its possibilities in your apparatus today.

Write for Bulletin 171-01

TYPE TH-2½A TRANSTAT FOR SINGLE PHASE OPERATION					
	VA	Frequency	Input Volts	Output Volts	Output Amps
		50° Centigrade Rise			
Nominal	300	50/60	115	0-115	2.6
Maximum	340	50/60	115	0-130	2.6
TYPE TH-2X-2½A TRANSTAT DUAL UNIT. OPEN DELTA CONNECTED FOR THREE PHASE REGULATION					
		50° Centigrade Rise			
Nominal	520	50/60	115	0-115	2.6
Maximum	590	50/60	115	0-130	2.6

AMERICAN TRANSFORMER COMPANY, 178 Emmet St., Newark 5, N.J.

AMER TRAN

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERTRAN

Electrical Wiring is Basic!

That's why Anaconda's national advertising drive is important to every electrical utility

ANACONDA's advertising campaign is aimed at creating a sounder basis for your postwar business. It urges postwar planners to allow extra capacity in wiring plans. It puts the spotlight on the big increase in the demand for power and equipment sure to come.

Don't overlook the opportunity to tie in with this special campaign. Plan now to get a maximum share of its benefits. Link your own promotion to your local adequate wiring bureau activities and Anaconda's basic advertising theme: It's always wiser to Wire Ahead!

BUY MORE WAR BONDS

Know where that postwar plan of yours ought to START?
THINK AHEAD Electrically
How many "VICTORY" JOBS will result from
increased use of Electric Energy
ANACONDA WIRE & CABLE COMPANY
Electrical Wires and Cables of Copper are the Life Lines of our Nation

Full-page Anaconda advertisements running regularly, in color, in Time, Newsweek, Business Week, and a list of industrial publications reaching America's leading postwar planners.

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4... Sales Offices in Principal Cities

Electrical Wires and Cables of Copper are the Life Lines of our Nation

—from the COMPLETE LINE OF

OLIVER POLE LINE MATERIALS

FOR ALL TYPES OF CONSTRUCTION

Clevises

MECHANICALLY *Strong*
ELECTRICALLY *Efficient*

You have found that the right clevis at the right time makes a neater, better, faster job of erection. Realizing that utility men need a variety of styles of clevises, Oliver has developed a complete line. Are you familiar with them? You will find styles for every type of application—every one designed, built and *service tested* under operating conditions.

They combine great mechanical strength with high electrical efficiency to provide long life and satisfactory service. Porcelain insulators are carefully selected for the job. Metal parts are made from open hearth steel, hot-dip galvanized.

It will pay you to become familiar with these important *economy aids* now!

All Oliver Clevises are described fully in Catalog 43, which covers the complete line of Oliver Pole Line Materials.

OLIVER
IRON AND STEEL
Corporation

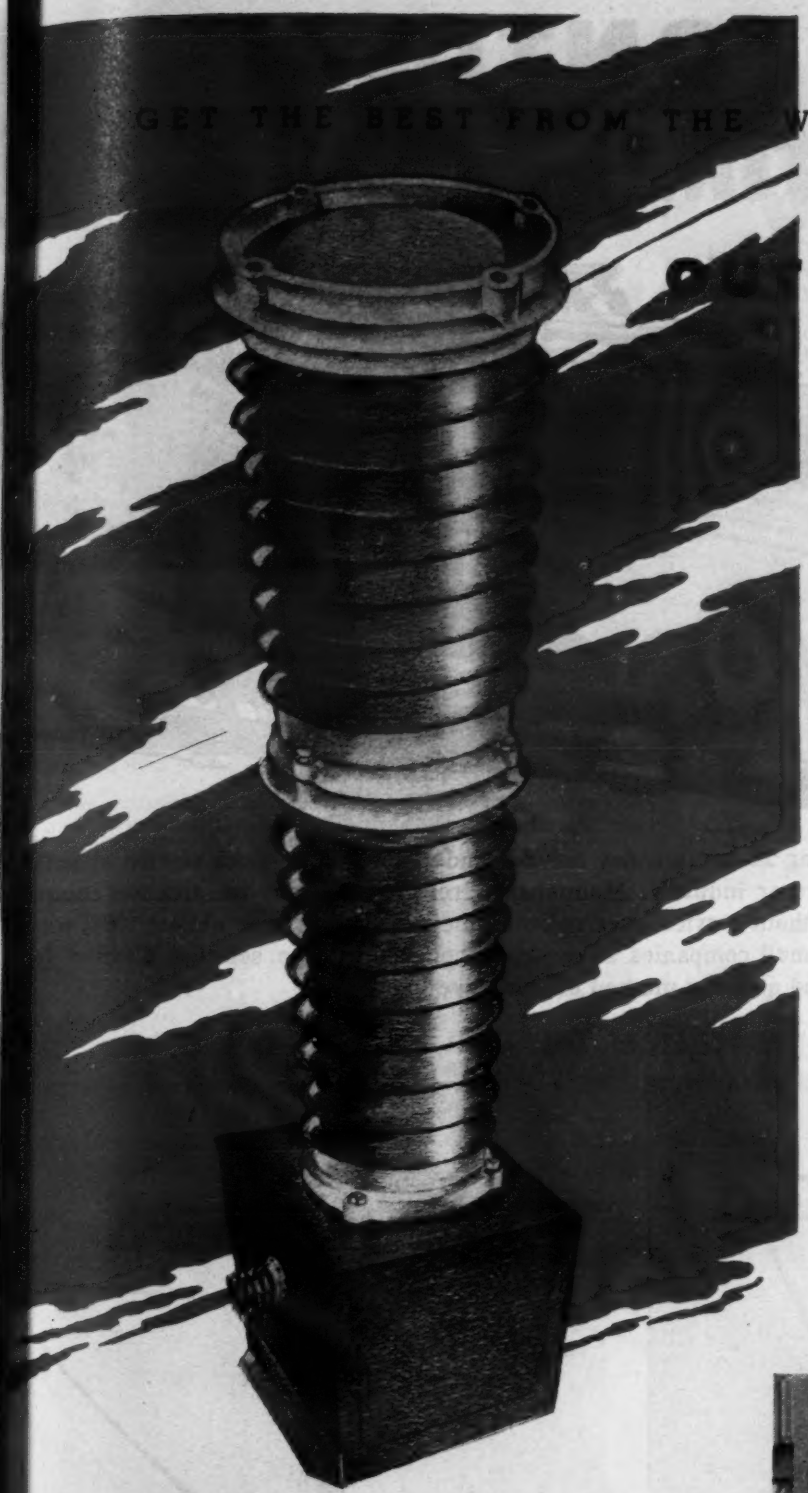
SOUTH TENTH AND MURIEL STREETS
PITTSBURGH 3, PA.

GET THE BEST FROM THE WORLD'S LARGEST

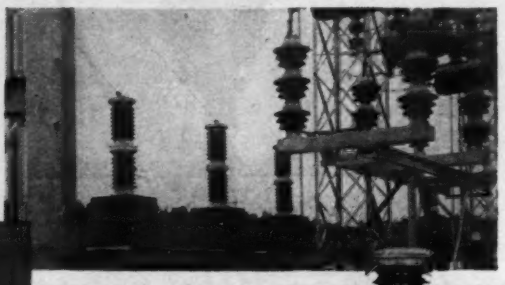
OUTSTANDING!

C-D leadership gives you a better carrier current coupling capacitor

Typical of Cornell-Dubilier's outstanding improvements in capacitor quality and design is the enlarged and superior Type CA unit for carrier current coupling. Type CA's fog-type petticoats provide a large creeping distance between terminals . . . are designed for low resistance at high frequencies. Galvanized malleable iron mounting flanges permit stacking for high voltage connection. Base and top are specially sealed for leakproof service and new inner construction gives great tensile strength. Investigate this improved type of carrier coupling capacitor. Your local C-D field engineer will be glad to answer questions or write Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.



.001 mfd. 76 Kv outdoor coupling capacitor with mounting base containing drain coil gap and shorting switch

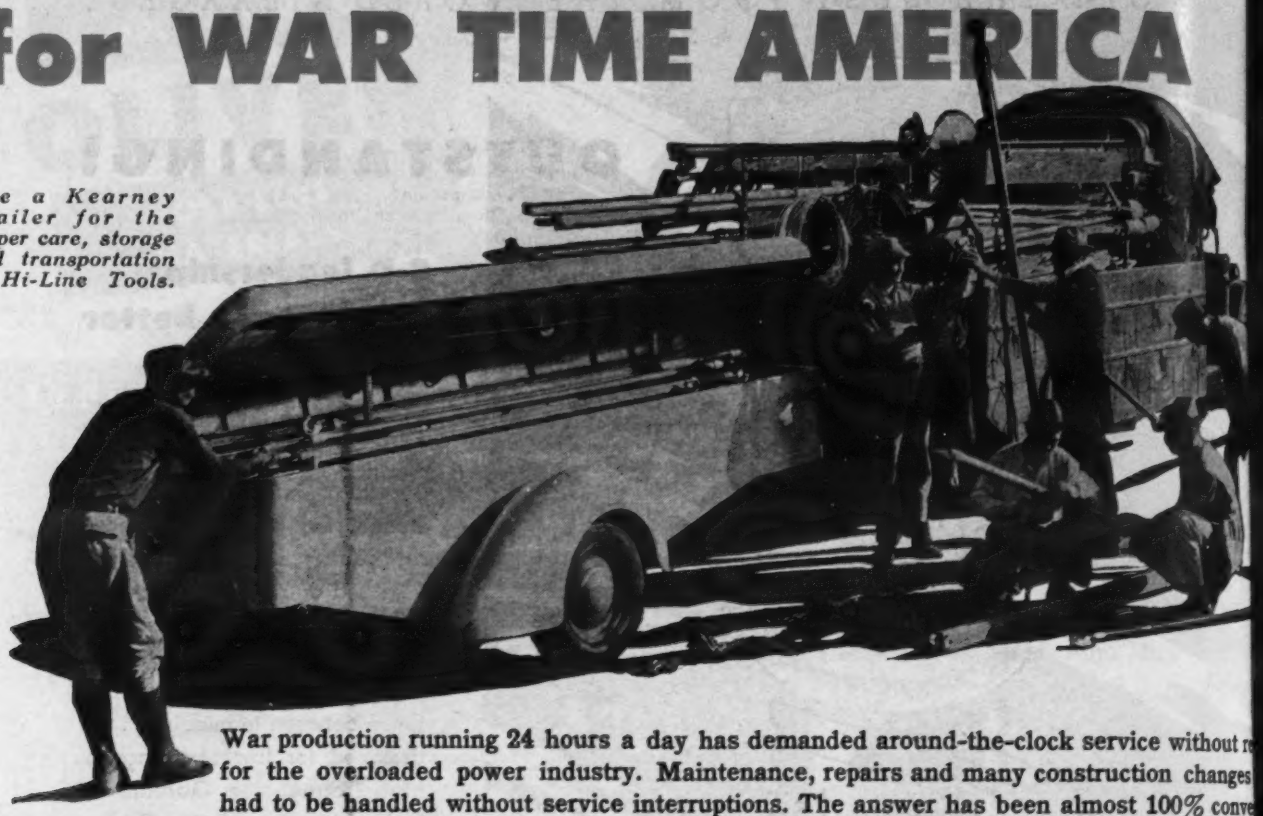


AN INSTALLATION OF TYPE CA CAPACITORS *for coupling carrier communication and signalling on a 110,000 volt, 3 phase grounded neutral line. Each capacitor is rated 76,000 volts. The base is large enough so that auxiliary potential equipment may be mounted.*

CORNELL-DUBILIER CAPACITORS

FOR POWER FACTOR IMPROVEMENT
CARRIER CURRENT COUPLING
SURGE PROTECTION

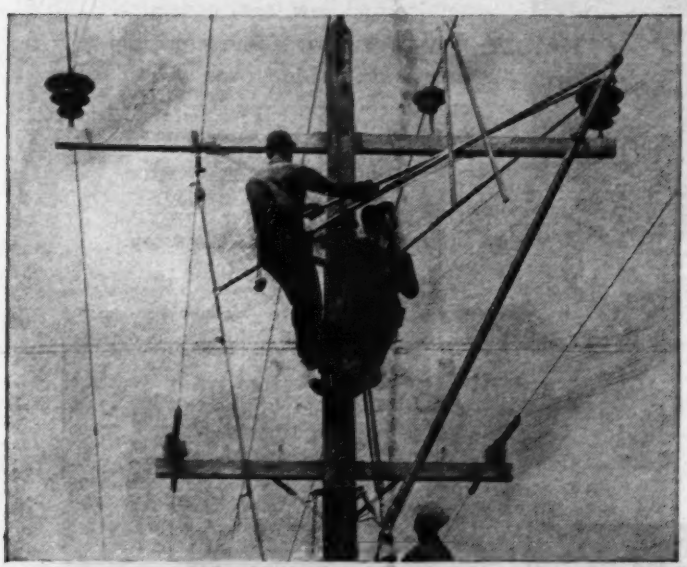
SERVICE CONTINUITY for WAR TIME AMERICA



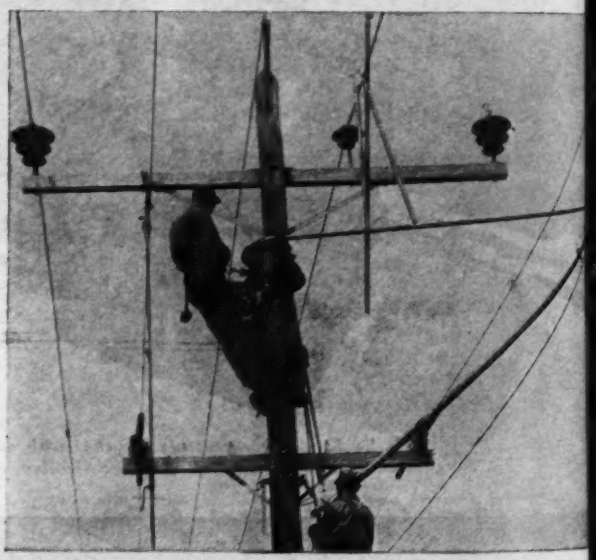
Use a Kearney Trailer for the proper care, storage and transportation of Hi-Line Tools.

War production running 24 hours a day has demanded around-the-clock service without re for the overloaded power industry. Maintenance, repairs and many construction changes had to be handled without service interruptions. The answer has been almost 100% conve to the use of Hi-Line Tools by large and small companies alike. Most companies have selected Kearney Too representing the safest, most convenient, and quickest method of doing live line work.

MAKING A HOT LINE INSULATOR CHANGE

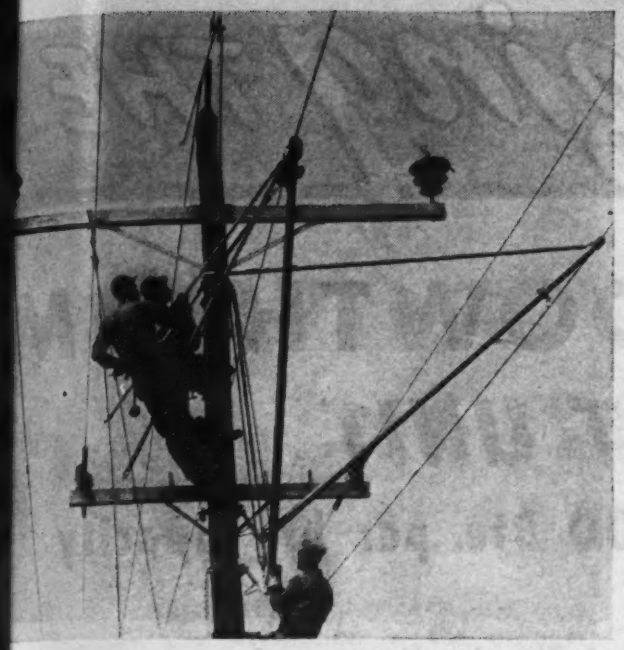


1. These four photographs show the steps taken in the rather simple operation of changing defective insulators. LIFT-POLS nd HAN-POLS are in place as the tie-wire is removed prepara- y to moving the No. 1 phase into the clear.



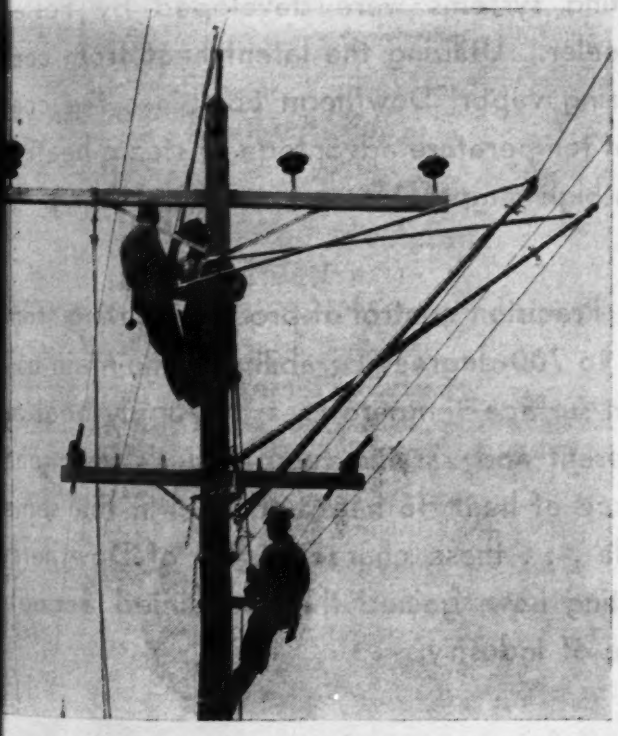
2. This view shows No. 1 phase moved and securely anchor the clear. Heavy lifting can be done by groundmen leavi linemen free to guide the tools as the phases are moved out. that LIFT-POLS are loaded in direct compression.

...Maintain Continuous Service-Use KEARNEY HI-L



Third step is similar to the first. No. 2 phase is secured with the LIFT-POLS and HAN-POLS. Tie-wires are removed and phase will then be raised up and over the end insulator.

ote that each phase is handled with individual pole grips and orts. This method eliminates the possibility of releasing the ng lift pole.



Both phases have been cleared from the pole after which the insulators are replaced by hand. This work has been omplished in about 15 minutes in a safe, convenient way with- service interruption.

TOOLS AVAILABLE FOR 6900 VOLTS TO 220,000 VOLTS

KEARNEY Hi-Line tools are unusually flexible in their use. With even the few tools pictured in the illustrations many maintenance jobs can be performed. Typical of the more commonly used tools are those listed and shown below. Questions on your live line maintenance problems are invited.

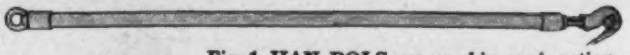


Fig. 1. HAN-POLS are used in conjunction with LIFT-POLS to manipulate live conductors. Also for holding under arm jumpers at a safe distance from the lineman.

Fig. 2. INSULATED PLIERS OR CUTTERS are available on 1¼ and 1½ inch diameter laminated oak handles, tested to 75,000 volts per foot. The insulated handles will accommodate heavy duty cutters, and either 8 or 9 inch side cutting pliers or gas pliers.

Fig. 3. COMBINATION TIE STICK removes or installs tie wires. Blade-Type Sticks with Prong-Type Heads on lower end.

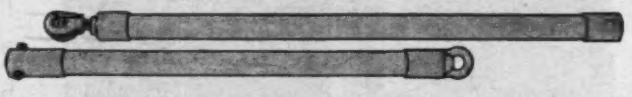


Fig. 4. LIFT-POLS are used for moving and supporting live conductors. Made of laminated spruce, 2, 2½ and 3 inch diameters, lengths up to 14 foot. Splices are available for any size LIFT-POLS.

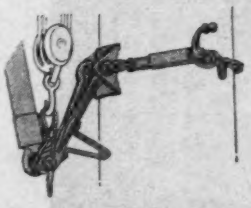


Fig. 5. The LIFT-POL-Lever is used similarly to the large Pol-Grips. However, it is attached to the swivel eye on the end of the LIFT-POLS when in use. Has sufficient travel to transfer conductor from pole pin position over the end of a ten-foot standard line arm.

Fig. 6. Pol-grips are used to guide and hold in position lift-pols and han-poles. Pol-grip-extensions are a means of off-setting one pol-grip from another, allowing LIFT-POLS or HAN-POLS to pass when it is necessary to install the grips in close quarters.

JAMES R. KEARNEY CORPORATION
4236 CLAYTON AVE. • • ST. LOUIS 10, MO.
Canadian Plant • Toronto, Canada
The Mark of Quality Products

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

NE TOOLS

Blazing THE

DOWTHERM

1932 FIRST UNIT

4,000,000 Btu. per hr. capacity

Original Dowtherm Vaporizer installed in 1932 furnishes proces heat for chemical production.

• The development of new processes in the early 1930's emphasized the limitations of the high temperature heating methods then available. In that period Dowtherm Vapor heating systems were developed by Foster Wheeler. Utilizing the latent heat from condensing vapor, Dowtherm combines the constant temperature advantage of steam heating with high temperature processing at low pressure.

Precision control of product heating from 400 to 700 degrees F.; ability to maintain uniform surface temperatures; to supply heat at different and varying temperatures from one source of heat; to heat and cool in the same cycle . . . these characteristics of Dowtherm heating have gained the unqualified acceptance of Industry.

Foster Wheeler is a four star winner under the U. S. Navy Board of Awards for production.

FOSTER WHEELER CORPORATION

FW **FOSTER**

ENGINEERING TRAIL

HEATING

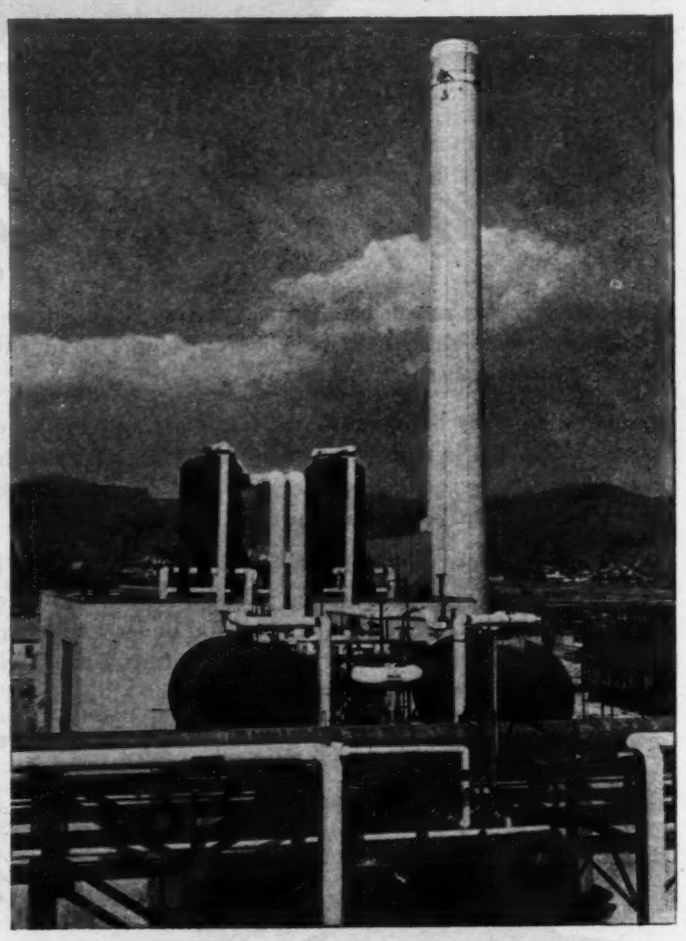
1944 164TH UNIT

35,000,000 Btu. per hr. capacity

• Since the installation of the original Dowtherm Unit for a relatively simple, high temperature chemical operation, the indirect heating system has been successfully adapted to a variety of processes in the chemical, petro-chemical and petroleum industries. Among these applications are:

Synthetic Rubber Production
Edible Oil Deodorization
Bodying of Drying Oils
Synthetic Resin Production
Phthalic Anhydride Purification
Fatty Acid Distillation
Esterification
Fat Splitting
Special Petroleum Processing
Plastic Moulding and Manufacture
Asphalt Processing and Coating
Wire and Cable Manufacture

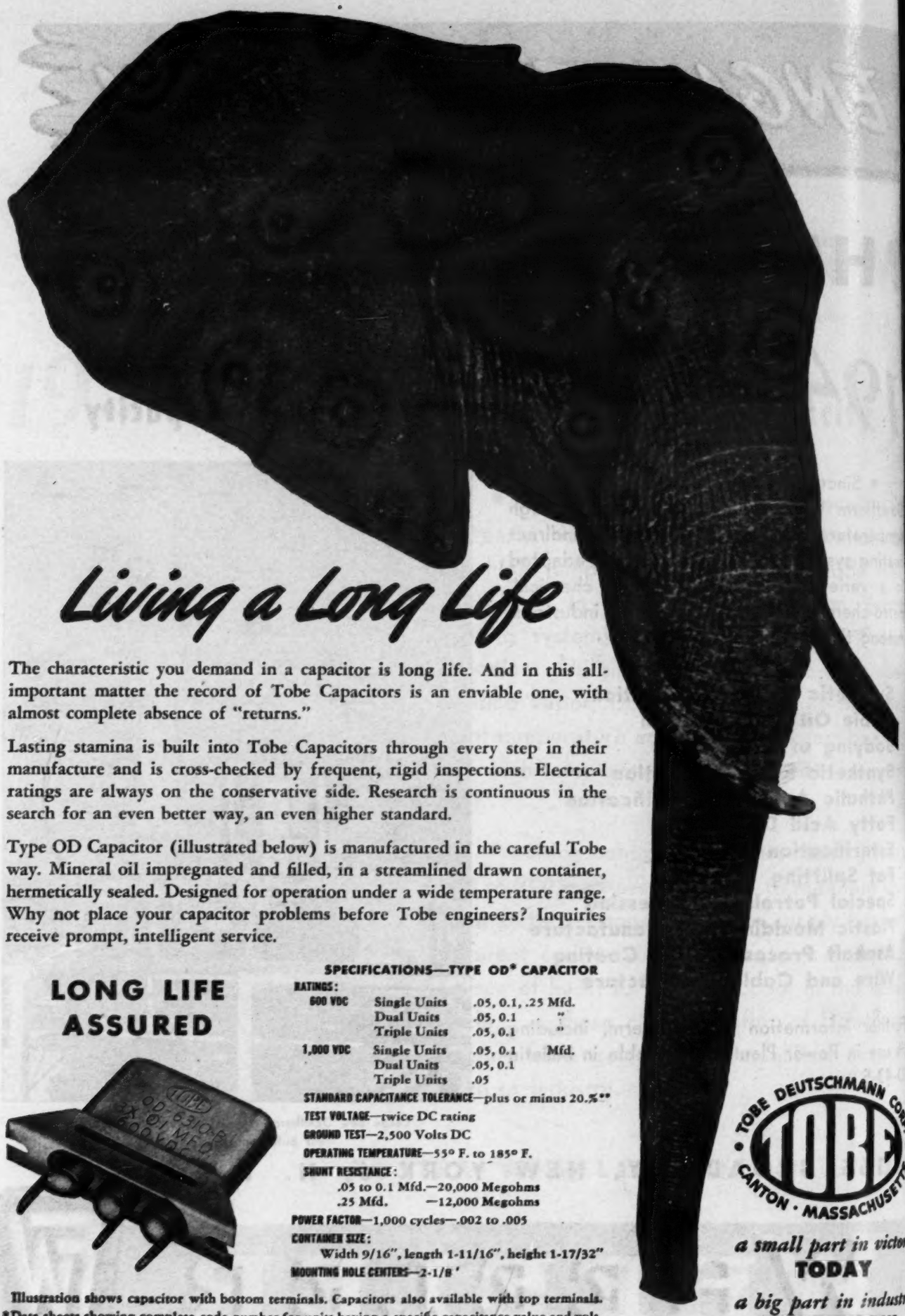
Further information on Dowtherm, including its use in Power Plants, is available in bulletin D-43-5.



Large new Dowtherm installation supplying process heat for butadiene production.

165 BROADWAY, NEW YORK 6, N. Y.

WHEELER FW



Living a Long Life

The characteristic you demand in a capacitor is long life. And in this all-important matter the record of Tobe Capacitors is an enviable one, with almost complete absence of "returns."

Lasting stamina is built into Tobe Capacitors through every step in their manufacture and is cross-checked by frequent, rigid inspections. Electrical ratings are always on the conservative side. Research is continuous in the search for an even better way, an even higher standard.

Type OD Capacitor (illustrated below) is manufactured in the careful Tobe way. Mineral oil impregnated and filled, in a streamlined drawn container, hermetically sealed. Designed for operation under a wide temperature range. Why not place your capacitor problems before Tobe engineers? Inquiries receive prompt, intelligent service.

LONG LIFE ASSURED

SPECIFICATIONS—TYPE OD* CAPACITOR

RATINGS:

600 VDC	Single Units	.05, 0.1, .25 Mfd.
	Dual Units	.05, 0.1 "
	Triple Units	.05, 0.1 "
1,000 VDC	Single Units	.05, 0.1 Mfd.
	Dual Units	.05, 0.1
	Triple Units	.05

STANDARD CAPACITANCE TOLERANCE—plus or minus 20.%**

TEST VOLTAGE—twice DC rating

GROUND TEST—2,500 Volts DC

OPERATING TEMPERATURE—55° F. to 185° F.

SHUNT RESISTANCE:
.05 to 0.1 Mfd.—20,000 Megohms
.25 Mfd. —12,000 Megohms

POWER FACTOR—1,000 cycles—.002 to .005

CONTAINER SIZE:
Width 9/16", length 1-11/16", height 1-17/32"

MOUNTING HOLE CENTERS—2-1/8"

Illustration shows capacitor with bottom terminals. Capacitors also available with top terminals.
*Data sheets showing complete code number for units having a specific capacitance value and voltage ratings available on request. **Other tolerances available.

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

a small part in victory **TODAY**

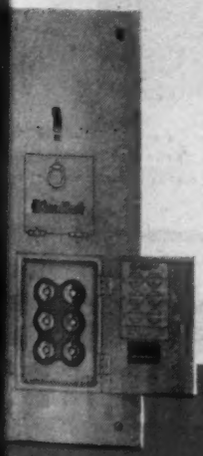
a big part in industry **TOMORROW**

There is a greater post-war potential in

RESIDENTIAL LOAD

than in any other

the wall is (FA) Load Center with 35 Amp. D. P. AC Thermag Circuit aker for Range Circuit, 25 Amp. D. P. for Water Heater, and six S. P. Thermag Circuit Breakers for light and appliance branch circuits. t. No. LC062-3L10F, list price $28.)



(FA) 6-Circuit Safety Type Service Equipment with 60 Amp. Tumbler Main Switch and Fuse. (Cat. No. SE 636-F, list price $12.50.)

A wiring job which might have been considered satisfactory a few years ago will be far from rendering desired service after the war. Shortage of domestic help has shown housewives the need for electrical appliances. To meet this pent up demand after victory, new post-war homes will have more complete wiring—more outlets for every possible device. Thousands of existing homes will be modernized, to this same end . . . In this lies a great opportunity for load building.

To provide for this increased load, the service wires, as well as the interior wires, must be of sufficient capacity. Ample branch circuit provision must also be made in the service equipment or load centers for additional outlets.

(FA) SERVICE EQUIPMENT and LOAD CENTERS

meet this and all other requirements. Available in circuit breaker type or fuse types (2 to 16 circuits), they are of correct design and known efficiency. Wide wiring gutters simplify connecting operations. (FA) Pressure Type (Solderless) Connectors in mains facilitate installation—as do the numerous knockouts . . . They are neat and attractive in appearance, and are obtainable for surface or flush installation. Approved by Underwriters' Laboratories, Inc.

Mass production of (FA) Service Equipment and Load Centers is attained by the use of standardized units as component parts. This results in equipment of high efficiency at lowered cost.

Write for Bulletin 63

It contains detailed information, with dimensions, capacities, prices and wiring diagrams, together with suggested specifications . . . Frank Adam Electric Company, Box 357, St. Louis 3, Mo.

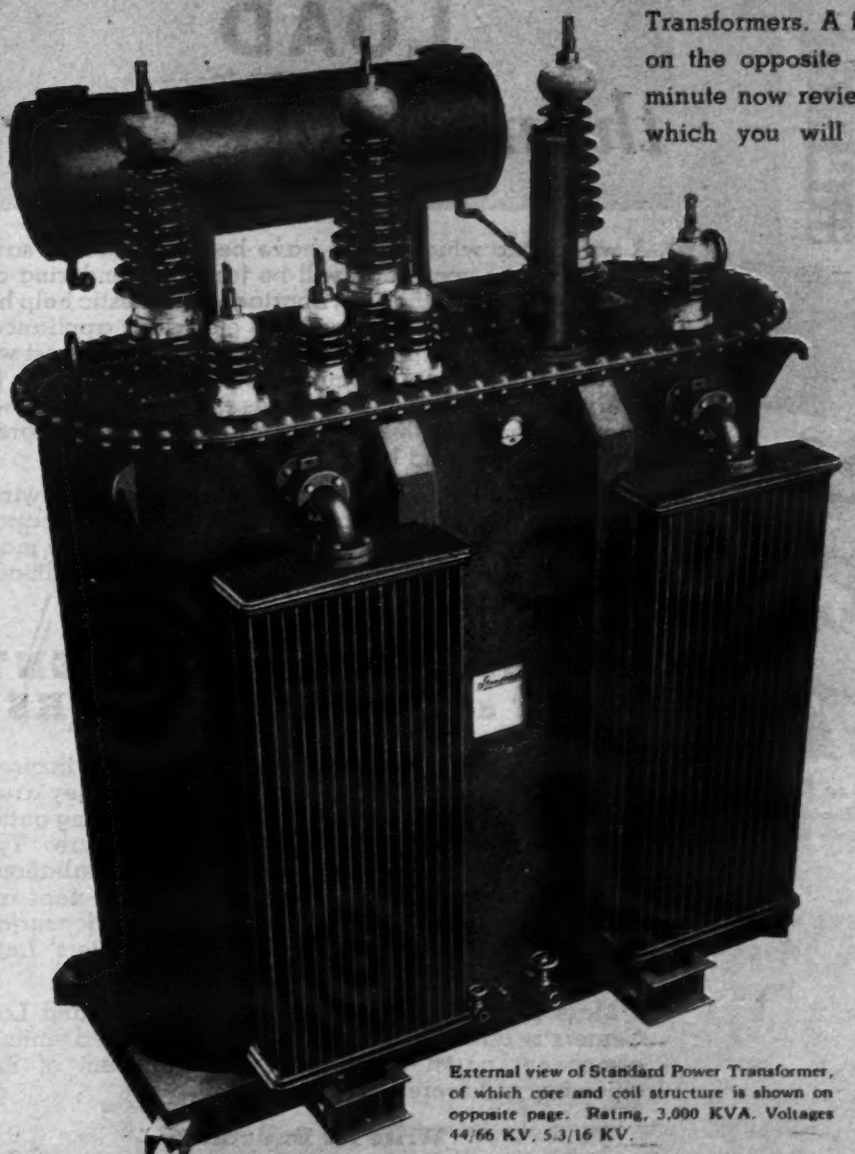
Frank Adam

ELECTRIC COMPANY

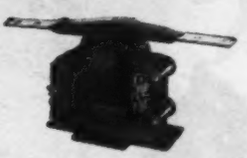
ST. LOUIS

Examine the features that make

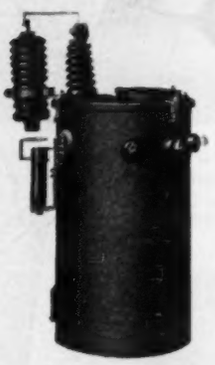
In addition to performance and rating figures, you cer-
tainly are interested in the engineering and structura
details of as important a piece of equipment as a trans-
former. We take great pride in the features that ar
responsible for the good service records of Standard
Transformers. A few of these details are highlighted
on the opposite page. It will pay you to spend a
minute now reviewing them, as they are points with
which you will want to be thoroughly familiar



External view of Standard Power Transformer, of which core and coil structure is shown on opposite page. Rating, 3,000 KVA. Voltages 44/66 KV, 5.3/16 KV.



Standard Instrument Transformers combine extreme accuracy with sturdy construction.



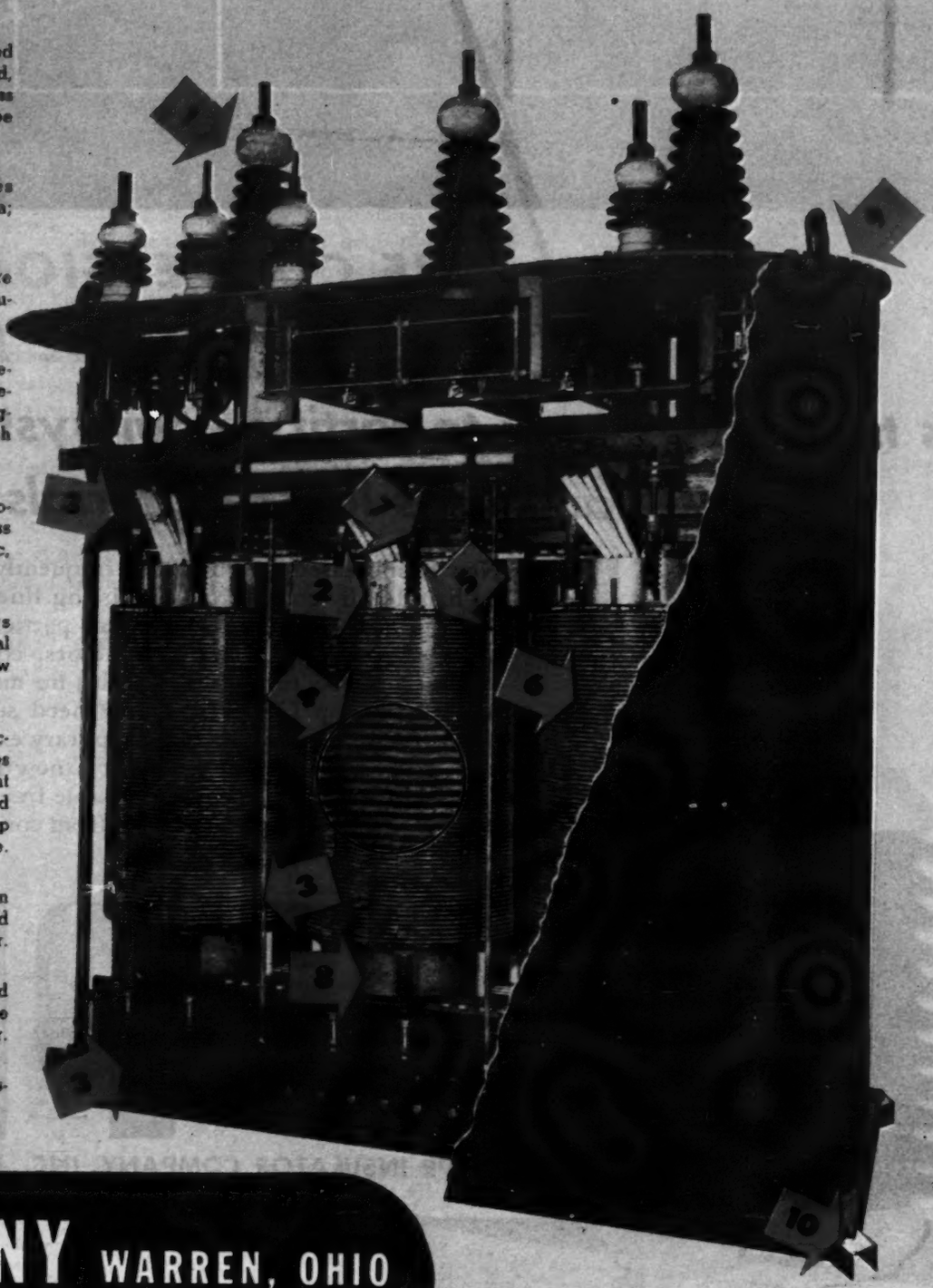
Standard makes a complete line of Distribution Transformers for Rural, Urban, Industrial and Building service.

THE STANDARD TRANSFORMER

For every class of service · Distribution and Power · Current and Potential · Askarel Cooled · Rura

Standard Transformers

DEPENDABLE... ECONOMICAL



1 Bushings, properly sized and spaced, are oil filled, brown glaze, wet process rcelain with spade type minals.

2 Core design provides double usual cooling area; is mechanically strong.

3 Rigid supporting structure assures long life and trouble-free operation.

4 Moisture completely removed from coils by preheating, vacuum impregtion with special varnish d baking.

5 Flashover protection provided by treated press board, varnished cambric, d insulating tubes.

6 Treated fibre spacers placed radially in vertical columns permit free flow oil to all parts of coils.

7 Unique spring construction on coil end braces permits slight movement coils under abnormal load thout damage and takes up y slack due to coil shrinkage.

8 Ample clearance between high voltage winding and core prevents flashover.

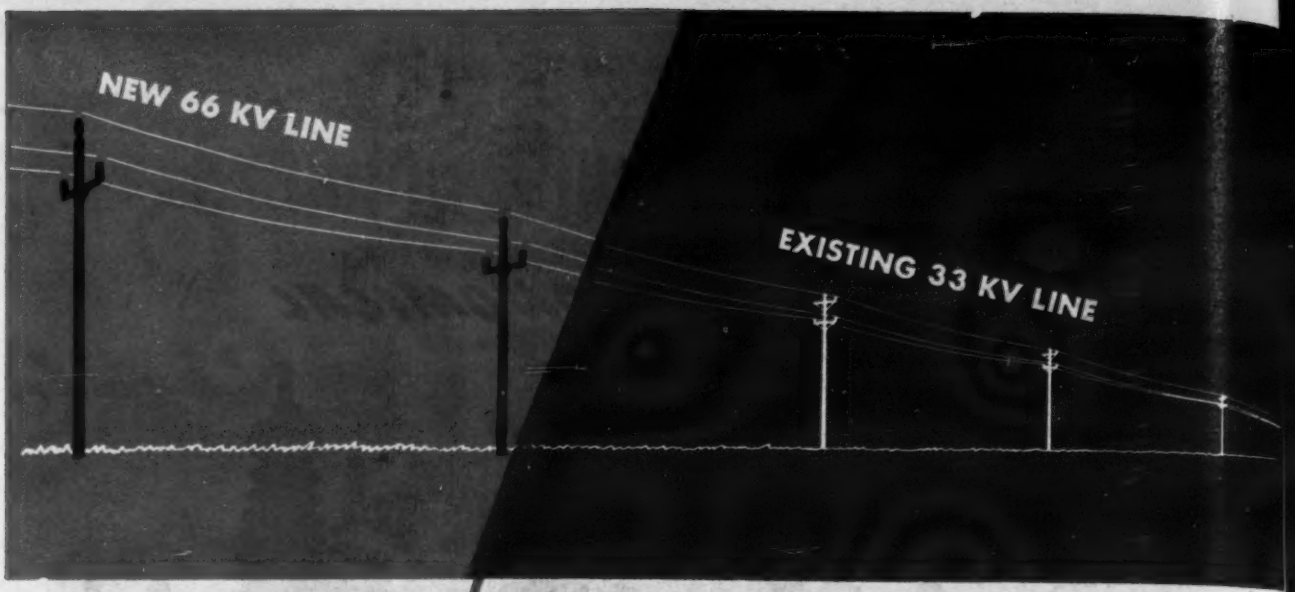
9 Specially developed gasket prevents leakage of oil or entrance of air.

10 Welded jack bosses assist in handling.

R COMPANY WARREN, OHIO

eneral Purpose Dry Type · Auto Transformers · Street Lighting

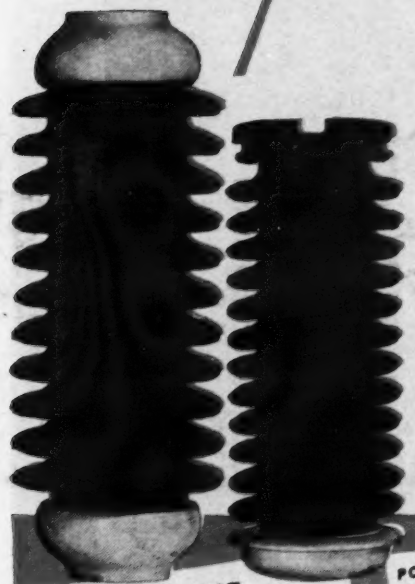
REPRESENTATIVES IN PRINCIPAL CITIES



LINE CONVERSION WITH LAPP LINE POSTS

is the fastest way to fortify your system.... and uses least materials

New or increased load demands frequently can most efficiently be handled by conversion of existing lines to higher voltage. For this job, Lapp Line Posts are particularly suited. Using present sound poles and conductors, conversion to higher voltages can be accomplished with no more than new cross-arms and Lapp Line Posts. Nor need such construction be considered as an emergency temporary expedient. Such a line approaches the current ideal for a new line; and your Lapp Posts can be expected to give trouble-free service for a longer period of years than you ever got from conventional insulators.



Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

LAPP LINE POST and STATION POSTS on your system offer . .

POWER ARCOVER. *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

NO CRACKING. *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

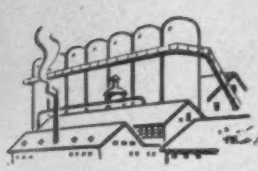
NO CLEANING. *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

NO PUNCTURE. *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

RADIO INTERFERENCE. *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

MECHANICAL RUGGEDNESS. *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

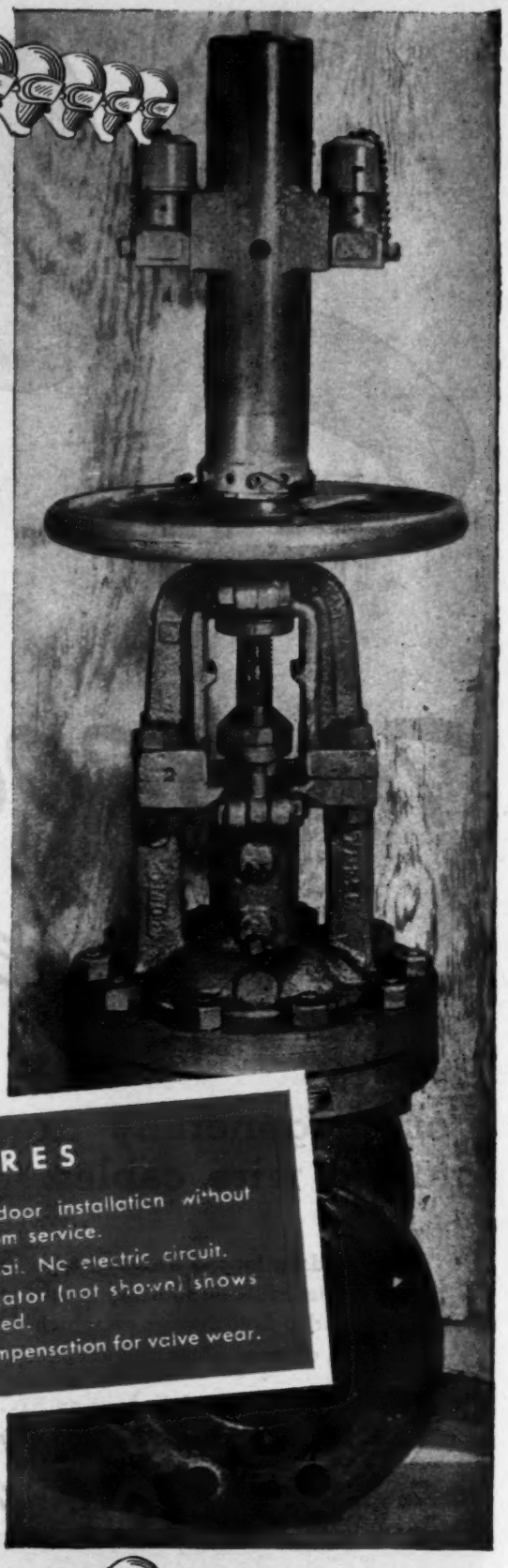
MECHANICAL GUARDIANS FOR CHEMICAL PIPE-LINES



In chemical industries, synthetic rubber plants, oil refineries... any plant, piping precious or potentially hazardous fluids... a mistake, whether unintentional or deliberate, in adjusting a chemical pipe-line valve can prove both dangerous and costly. But prevention of these human errors is easy and infallible with BENDIX-CORY* SAFETY INTERLOCKS... the locks that say "No!" to unauthorized handling of your valves.

The BENDIX-CORY SAFETY INTERLOCK illustrated gives absolute control over the opening and closing of the valve to which it is attached... and, by use of an interlock key, can also control the position of this valve in relation to any number of other valves. The unit is wholly mechanical, and fully adjustable to compensate for valve wear —one of a number of interlocks specially designed for valve protection.

As safety men of the Bendix "Invisible Crew," BENDIX-CORY SAFETY INTERLOCKS are dependable guardians for your pipe-lines. Write for full information.



CHECK THESE FEATURES

- Interlocks stem valves 2" to 8". Other interlocks for globe, lead and porcelain valves.
- Absolute control of valve opening and closing under all conditions.
- Positions valve in relation to other valves.
- Ample strength characteristics.
- Indoor or outdoor installation without removing valve from service.
- Fully mechanical. No electric circuit.
- Position indicator (not shown) shows valve open or closed.
- Adjustable compensation for valve wear.

*TRADE MARK OF BENDIX AVIATION CORPORATION

Products of this division are members of "The Invisible Crew"—precision equipment which 30 Bendix plants from coast to coast are speeding to our fighting crews on world battle fronts.

THE INVISIBLE CREW

Precision Equipment by

Bendix Aviation Corporation

BENDIX MARINE DIVISION • One Hanson Place, Brooklyn, New York

The 8200 Series

For all generally used ground wire cables.

This drop forged trunnion type ground wire suspension clamp combines strength and adequate cable-supporting length with lightness and smooth contact surface. The integrally forged U-Bolt Keeper on which the supporting bail is factory assembled results in a minimum of loose parts and simplicity of field application.

Why not get the full story on BTC clamps. Your copy of our Hi-Line reference book on request.

Through Your Insulator Manufacturer Only

BTC

Drop Forged Hi-Line Hardware

THE BREWER-TITCHENER CORPORATION
CORTLAND, NEW YORK

for...Speed

Low Cost

In Re-maintenance

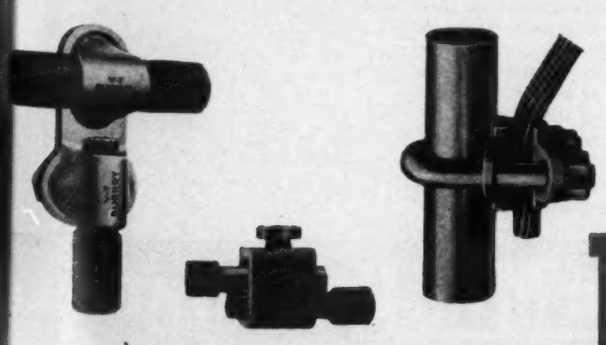
onnect With the Line of Least Resistance!

he war record of the electrical industry in "holding the line" nder unprecedented power demands, and the shortages of aterials and manpower, is a *monument of praise* to the main- nance engineers whose planning and "know-how" enabled em to conquer problems heretofore thought impossible.

This same "know-how" is now being brought to bear on the ig re-maintenance job just ahead . . . to insure maximum fficiency and *permanency* of many war-born installations.

Logically, Burndy engineers are cooperating on many of hese programs, for wherever *speed*, *permanency* and *low-cost* re the prime connector requirements, Burndy has the answer. his complete connector engineering service is yours, too, for he asking. Burndy Engineering Co., 107 Bruckner Boulevard, New York 54, N. Y.

IN CANADA: Canadian Line Materials, Limited, Toronto 13



Headquarters for CONNECTORS

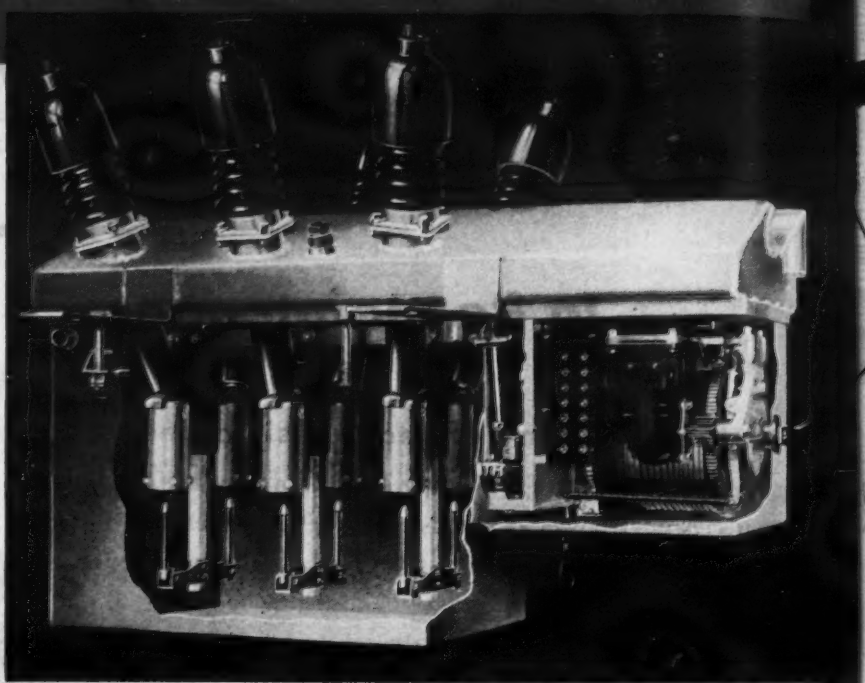
Burndy

Get rid of OUTAGES

CAUSED by TRANSIENT FAULTS

on Rural or Low-Revenue Distribution Lines

PACIFIC ELECTRIC'S *Motor-Rewound* AUTOMATIC SERVICE RESTORER



Type AP-40, 100 Amperes Continuous, 1800 Amperes Interrupting Rating, 15-kv.

CLEARS FAULTS IMMEDIATELY

3—Reclosure Protection Before Lockout on Sustained Faults

You can get rid of outages caused by blown fuses on rural or low-revenue distribution lines by installing the Pacific Electric Automatic Service Restorer.

It clears immediately any number of transient faults.

It is operated by an automatically-prewound spring. After the first reclosure, a 115-volt motor starts rewinding the spring, taking 60 seconds rewinding time for the energy expended in each reclosure operation. If faults are 60 seconds apart, the spring is always fully wound—giving 3-reclosure protection at all times before lockout which occurs on sustained faults.

There is a choice of reclosing intervals, also easy outside adjustments of current and inverse-time-delay tripping. Emergency manual operation is provided.

To save oil and contacts, the Automa Service Restorer has the Expulsion Co tacts which clear arcs rapidly.

All of this adds up to greater safety a a saving of line patrolling. So ask f full details about the Motor-Wound Au matic Service Restorer which gets rid outages caused by transient faults scores of installations the nation ov One of these restorers successfully clear 242 faults in 8 days, during a sleet storm without lockout.

C. H. Cutter
1015 Securities Bldg.
Seattle 1, Wash.

G. B. Kirkwood
437 S. Hill St.
Los Angeles 13, Ca

J. E. Redmond Co.
448 W. Madison St.
Phoenix, Ariz.

Pierce G. Fredericks
90 West St.
New York 6, N.

Other Representatives in Principal Citie

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO 24, CALIF. P. O. BOX 419, GARY, INDIANA

SOLID ROCK or SANDY LOAM

. . . regardless of soil condition, Hoosier service assures the most efficient and economical method of handling every transmission line erection or maintenance job. Today this organization of trained men and special equipment is available to supplement your own organization in maintaining adequate service.

HOOSIER
ENGINEERING CO.

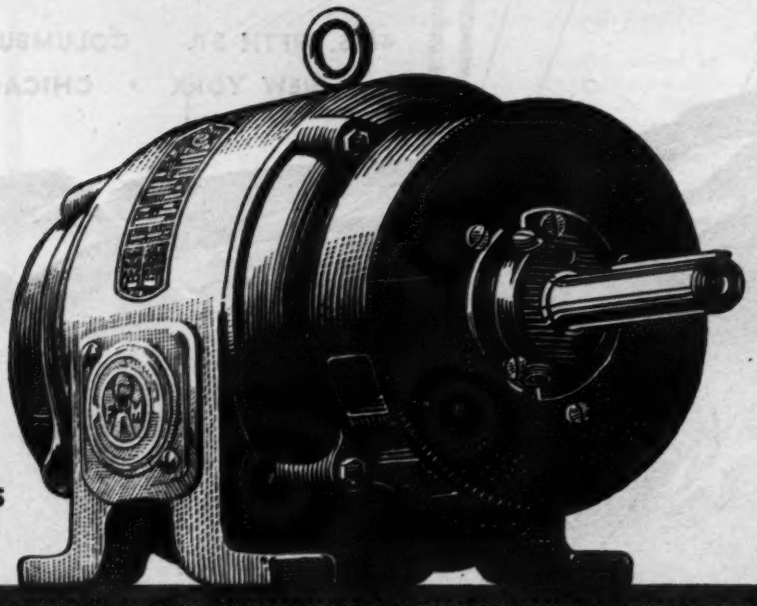
46 S. FIFTH ST. COLUMBUS, OHIO
NEW YORK • CHICAGO

RECTION AND MAINTENANCE OF TRANSMISSION LINES

A name worth remembering!

FAIRBANKS-MORSE

After the war, the name Fairbanks-Morse will continue to mark performance-proved products only, as it has for 114 years. No race to get civilian products onto the market early will tempt us to break this pledge.



Features of the New Fairbanks-Morse General-Purpose Motor

- *It is a 40° C. motor.*
- *It is a protected motor.*
- *It has an optional conduit box assembly.*
- *It has cross-flow ventilation.*
- *It has ball bearings, sealed in and protected.*
- *It has the exclusive Fairbanks-Morse* Copperspun Rotor.

BUY MORE WAR BONDS

DIESEL LOCOMOTIVES • DIESEL ENGINES • GENERATORS • MOTORS • SCALES • PUMPS • STOKERS • RAILROAD AND FARM EQUIPMENT

FAIRBANKS, MORSE & CO., CHICAGO ., ILLINOIS

utting Hours from Construction and Maintenance Time . .

★ It takes less than two minutes to bore holes through frost, shale, rock, hardpan, gumbo, sand, gravel—in swamps and on hillsides. That's one of the reasons why HIGHWAY Earth Boring Machines are used so extensively. This advanced method for "boring the hole and setting the pole" is something to think about now. It may not be long before extensive line construction activity gets under way and it is for such time that carefully laid plans should include the HIGHWAY Earth Boring Machine.

The HIGHWAY has the power and strength to operate with the largest truck and tractor motors—it is sufficiently light in weight and compact in construction to be practical on 2½- or 3-ton trucks.

Clipping hours from schedules will no doubt be an important factor in new construction and here is a way of accomplishing it easily.

Bore the Hole And Set the Pole

HIGHWAY TRAILER COMPANY

MANUFACTURERS OF

TRUCK TRAILERS AND BODIES • EARTH BORING MACHINES • WINCHES • OTHER PUBLIC UTILITY EQUIPMENT

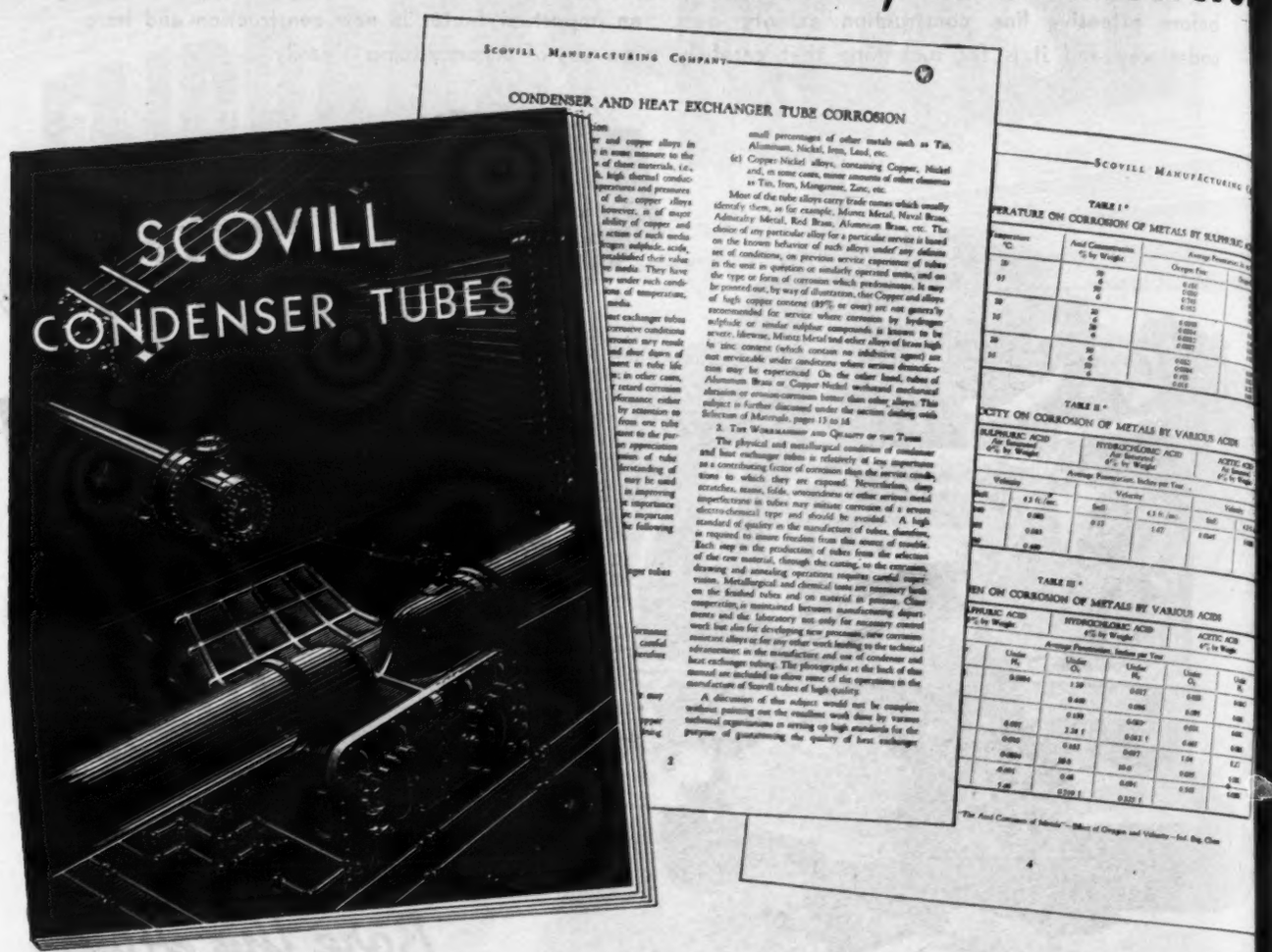
General Offices

EDGERTON, WIS., U. S. A.

Scovill Tube News

Vol. 2 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn No

New Scovill "Condenser Tube Booklet Gives Facts On Selection, Installatio



Corrosion

The booklet has a color illustrated section on corrosion, as it affects condenser and heat exchanger tubes. Gives the factors that influence tube life — from alloy composition to service conditions. Discusses the six important types of tube corrosion and the corrodants involved. Amplifies on *stress, season* and *corrosion-fatigue* cracking.

Composition of Tube Metals

A separate chapter deals with the composition and physical properties of tube metals such as: Muntz Metal, Admiralty Metal, Phosphorized Admiralty, Red Brass, Deoxodized Copper, Arsenical Copper, Aluminum Brass, 70–30 Copper-Nickel, and 80–20 Copper-Nickel. It gives their nominal composition and the when, why and where their use in condenser-tube and heat exchanger fields.

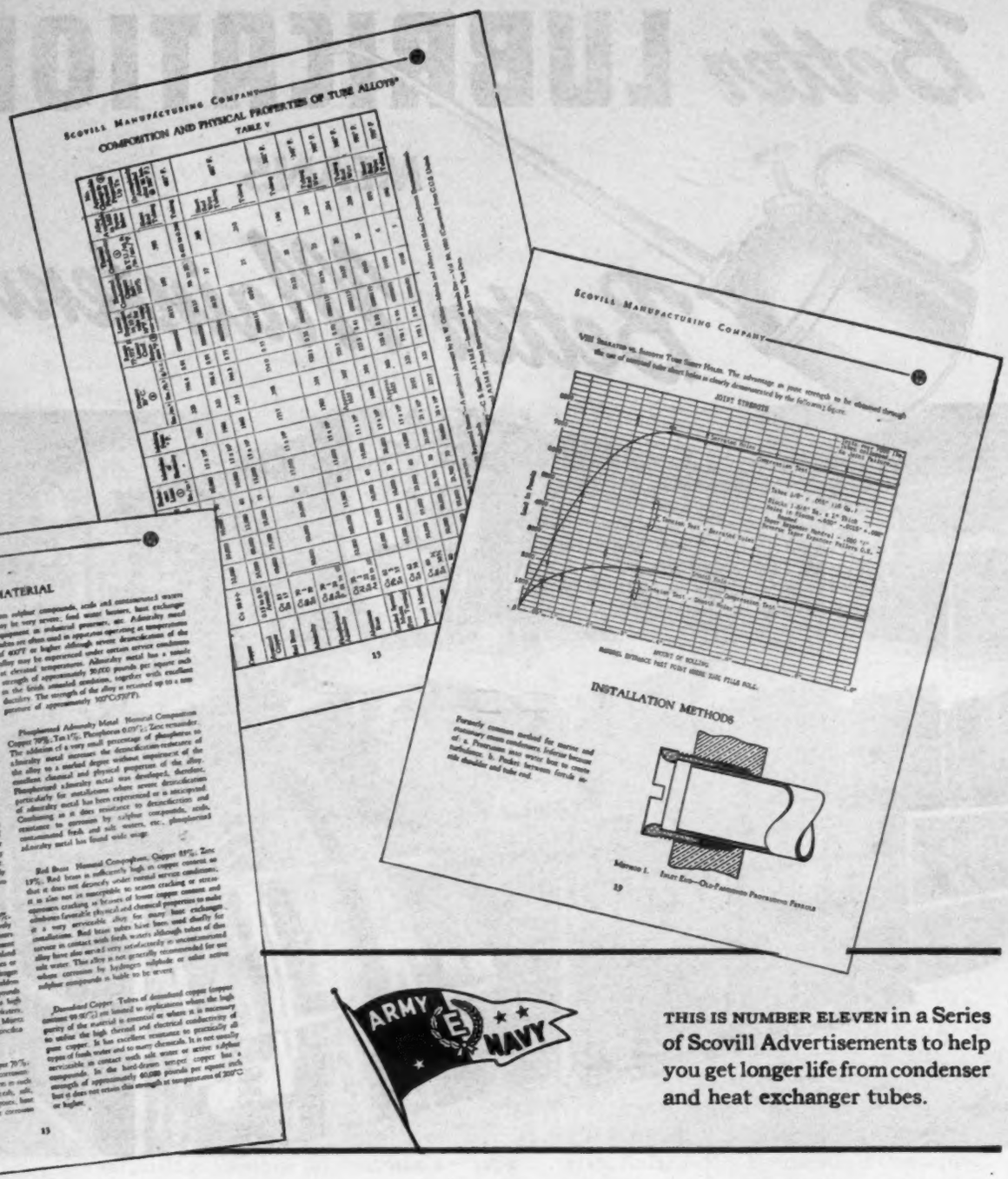
In this new booklet of tube facts, Scovill engineers have compressed a brief of many years of tube experience into some 56 pages. The result is a practical and understandable handbook that tube users will find useful.

Tube Installation

Another section concerns the importance of proper installation, methods of installation, the proper tools. Adequately illustrated with photographs, diagrams, charts and data tables.

Production Methods

Scovill explains the detail of the processes used in tube manufacturing. Thirteen full-page photographs give a good understanding of these processes.



ARMY E NAVY

THIS IS NUMBER ELEVEN in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

In Conclusion

Scovill's new "Condenser Tube Booklet" provides useful reference pages on Gauge Sizes, Inch Conversion Tables, Temperature Conversion Tables, Per Foot Weights of Scovill Condenser Tubes, Weights of Common Scovill Alloys, Pertinent Formulas and Physical Constants, Heat Unit Terms and Definitions and Conversion Factors with their definitions.

Other Scovill Services

It is by means such as this that Scovill renders its *Service in Manuals*. Other Scovill services include *Service in Metals* and *Service in Men*. The first makes the complete laboratory facilities of Scovill available for the determination of the alloy best suited to your needs. The latter gives you close cooperation from Scovill engineers in planning proper installation or investigation where necessary. Scovill Manufacturing Co., 24 Mill Street, Waterbury 91, Conn.

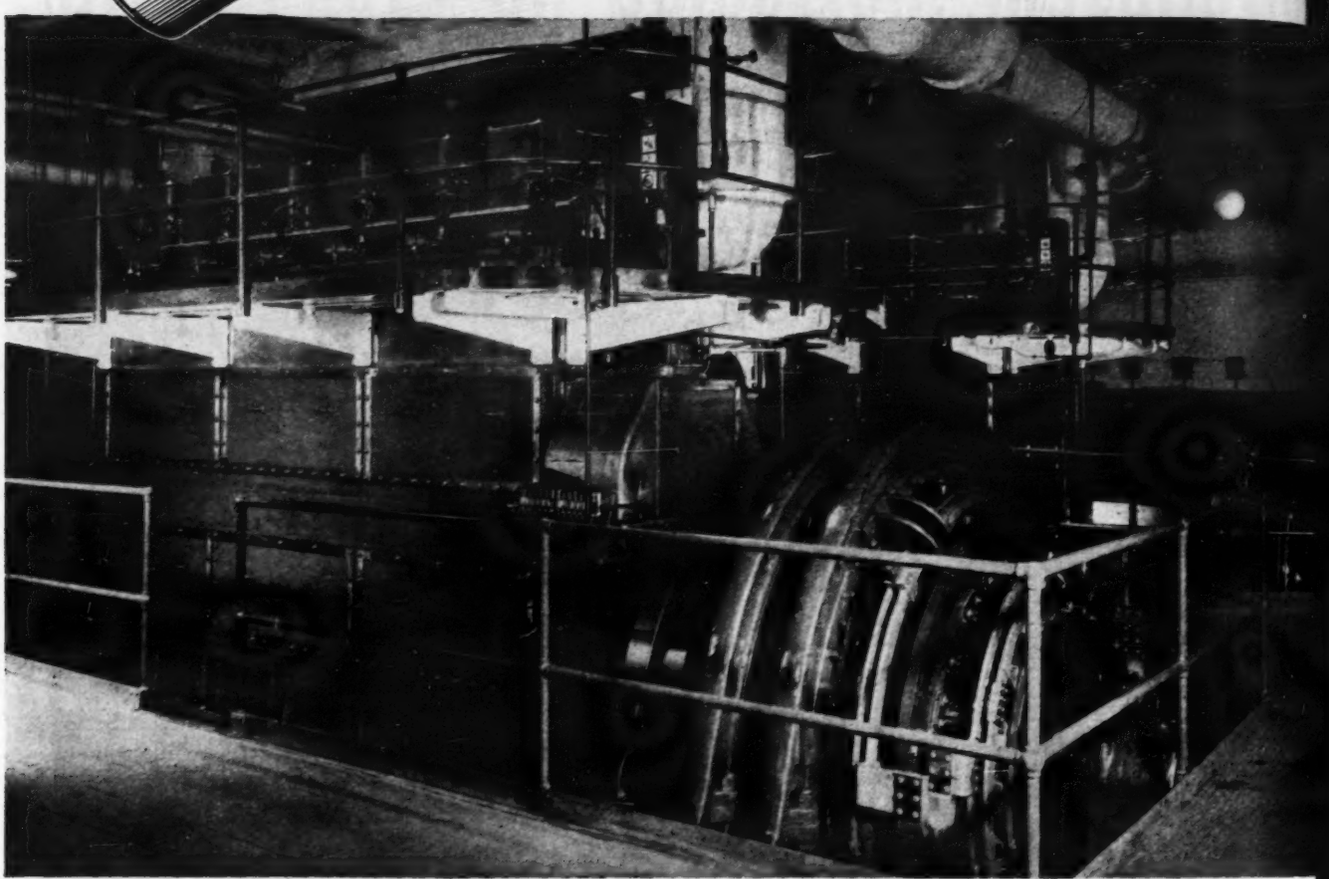
Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men

Better LUBRICATION MEANS *Better Maintenance*



• Excessive wear and difficult maintenance often result from inadequate lubrication.

Sinclair provides Rubilene and Gascon Oils for *better lubrication* of *DIESEL ENGINES.* They are non-corrosive, sludge-resistant, and assure complete power seal . . . maintain safe lubricating film under continuous heavy duty operation.

• • •

(Write for "The Service Factor" — published periodically and devoted to the solution of lubricating problems.)

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N.

SPEAKING OF CUSTOMER GOODWILL . . .

Blown fuses and customer goodwill simply don't go together. For, right or wrong, a surprising number of customers—especially the women, blame the Utility for these annoying service interruptions.

The average housewife is far from electrically minded. She only knows that a blown fuse is, at best, a nuisance. Even after she has located a burned-out fuse and found a new one to replace it, she still doesn't like the idea of switching them. But what really puts her in a dither is to discover that she's run out of spare fuses—that the stores are closed—that she'll just have to wait for the Utility service man. As far as Mrs. Housewife is concerned, this blown fuse situation very definitely is "something somebody should be able to do something about."

Utilities which *have* done something about it, have profited handsomely. By installing Multi-breakers instead of fusible equipment, they have reduced service calls and revenue losses—substantially. Most important of all, they have built a lot of very valuable customer goodwill.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Good BY NATURE

BETTERED BY Science

Life-Span Tox-i-tized Cedar Poles

In Life-Span Cedar Poles, science has successfully lengthened the naturally long service life of cedar poles. Life-Span's full-length tox-i-tizing treatment fortifies the entire sapwood with long lasting, active resistance to decay and termites. That means extra years without up-keep or replacement. Specify Life-Span!

Life Span

Sold only by the following:

SCHAEFER-HITCHCOCK
Sandpoint, Idaho

Suppliers for Joslyn

NAUGLE POLE & TIE CORP.
Minneapolis, Minn.

PAGE AND HILL CO.
Minneapolis, Minn.

50 Church St., New York, N. Y.

B. J. CARNEY & CO.
Spokane Minneapolis

CONSOLIDATED TREATING CO.

The name "U.S. ROYAL" has long been reserved by this Company for rubber products of exceptional quality.

U.S. Royal Cords and Cables, as an example, have been known for many years for their balanced construction, flexibility, dielectric strength, smoothness of finish and physical toughness.

Now comes a new development in rubber technology, greatly speeded by critical war-time needs... a new insulation material, "Safety-Tested" for every desired quality. This has been successfully embodied in the new line of U.S. ROYAL CORDS and CABLES... a line that offers to the electrical industry the assurance of long, economical, trouble-free service... a line truly worthy of the name "Royal".

Serving through Science

Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.

This new turbo-generator set is simplified and modern. Designed by Hendy, it wraps up in a single power package many important features shown by experience to contribute to reliability and economy.

For one example, its governor is a new type. It requires no stuffing boxes or soft packing and it uses anti-friction bearings in the linkages, providing extremely accurate governing. The Hendy HG-26 set incorporates many design refinements of this kind. This, combined with the fact that throughout it is built with the same precision workmanship standards set by Hendy in the manufacture of its marine main-propulsion turbines, makes this set a smooth and efficient power plant.

Hendy ac or dc turbo-generator sets beginning at 250 kw can be built to your requirements. Write for complete information or, better yet, talk over your power problem with us at your nearest Hendy office.

JOSHUA HENDY IRON WORKS

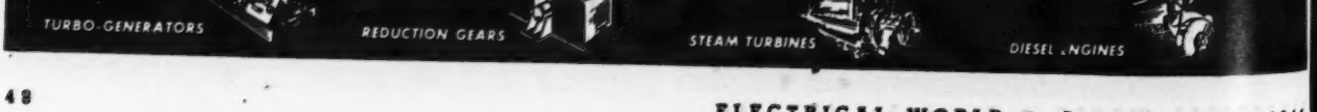
ESTABLISHED 1856

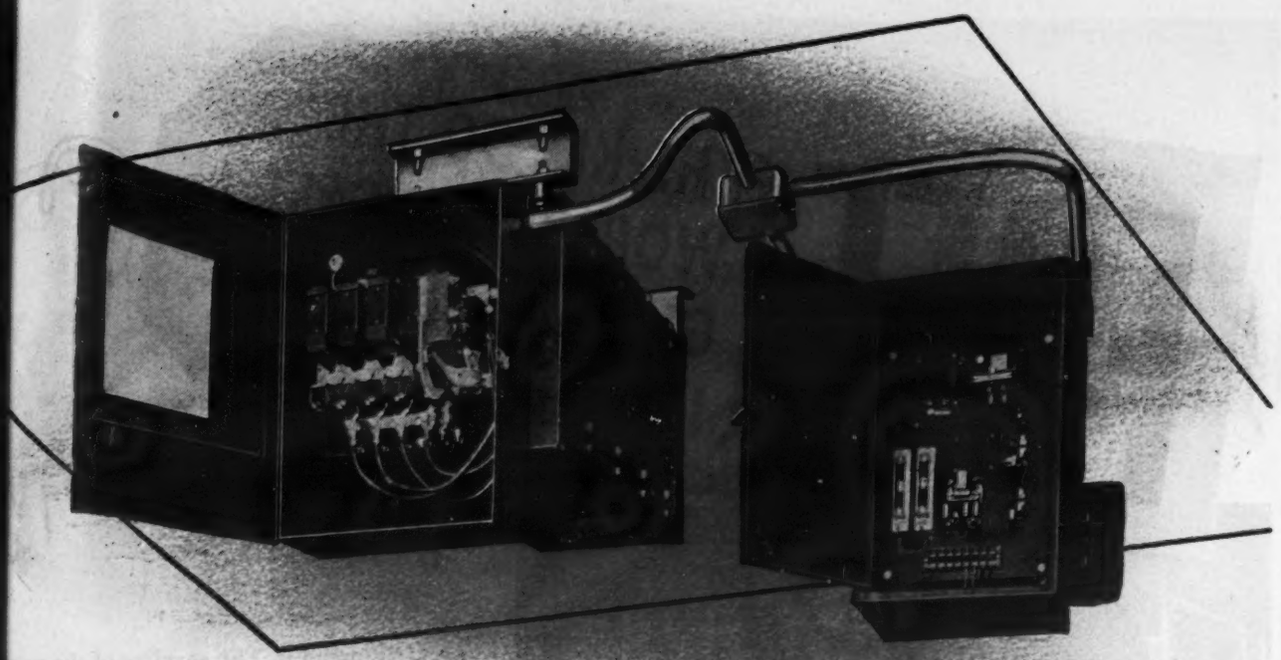
SUNNYVALE, CALIFORNIA

For complete data write for new catalog on Hendy Type HG-26 Auxiliary Turbo-Generator sets.

46-V

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON • LOS ANGELES





ONE CAPACITOR INSTALLATION *that did 2 jobs...*

Automatic control corrects voltage swings as well as power-factor for Buffalo war plant

A Buffalo war plant was faced with the problem of providing added system capacity with least possible modification of existing electrical equipment. It also had a problem of extremely poor voltage regulation due to a recent changeover from 25 to 60-cycle power using, in some cases, the same transformers.

Capacitors solved both problems. A total capacity of 3400 kv-a was installed, effectually correcting both conditions. It was found that during periods of light loads, excessive voltage rises would occur on some of the feeders. Westinghouse application engineers solved this problem by providing voltage-controlled automatic switching of the capacitors. When voltage is low, the capacitors are connected; when voltage rises, their corrective effect is cut off. Voltage, as a result, is now held to a minimum variation, regardless of load conditions.

J-60554

Power-factor correction pays ...now and postwar

PERMANENT AS WELL AS TEMPORARY BENEFITS. Capacitors not only relieve war-crowded power lines of wattless current now, but offer permanent savings in power costs.

CONTROLLABLE TO MEET FLUCTUATING CONDITIONS. Automatic control can be used to apply correction only when required.

CAPACITORS EASILY RELOCATED. Whether installed indoors or out, capacitors can be easily relocated when low power-factor conditions on the system change.

Westinghouse application engineers will be glad to help you check on possible benefits from capacitors. Investigate today. Send for D. D. 49-210, "Automatic Switching of Capacitors". Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

CAPACITORS

FREE { THE KEY TO THE WORLD'S BIGGEST GLASS RESEARCH LABORATORY!

WE mean it. The services of the world largest glass research laboratory a yours for the asking. In its 75 years, Cornin has developed more than 25,000 differe glass formulae . . . a vast storehouse of glas making research and skill ready and ab to help you no matter what your proble

At Corning, right now, more than 2 planners, researchers, engineers and pr duction men are constantly at work to ma better glass for the radio tubes, X-ray bulb cathode ray tubes, resistor tubes and oth glassware you need in your business. As result, it is difficult to find *any* electron glassware in use today that did not get i start at Corning.

Actually, many of Corning's developmen come properly under the head of "ne miracles". It was only yesterday, for instanc that it became practical to solder met to glass. But Corning Research did it. An today the Corning metallized bushing performing an important job in the ele tronic equipment of the industry's leadin manufacturers . . . a proven time and mone saver. And we could quote a dozen oth examples just as good.

If you'd like to know more about wh Corning knows about electronic glassware we have a suggestion. Write today for new booklet, "There Will Be More Gla Parts in Postwar Electronic Products" Please address the Electronic Sales Dept., W Bulb and Tubing Division, Corning Glas Works, Corning, New York.

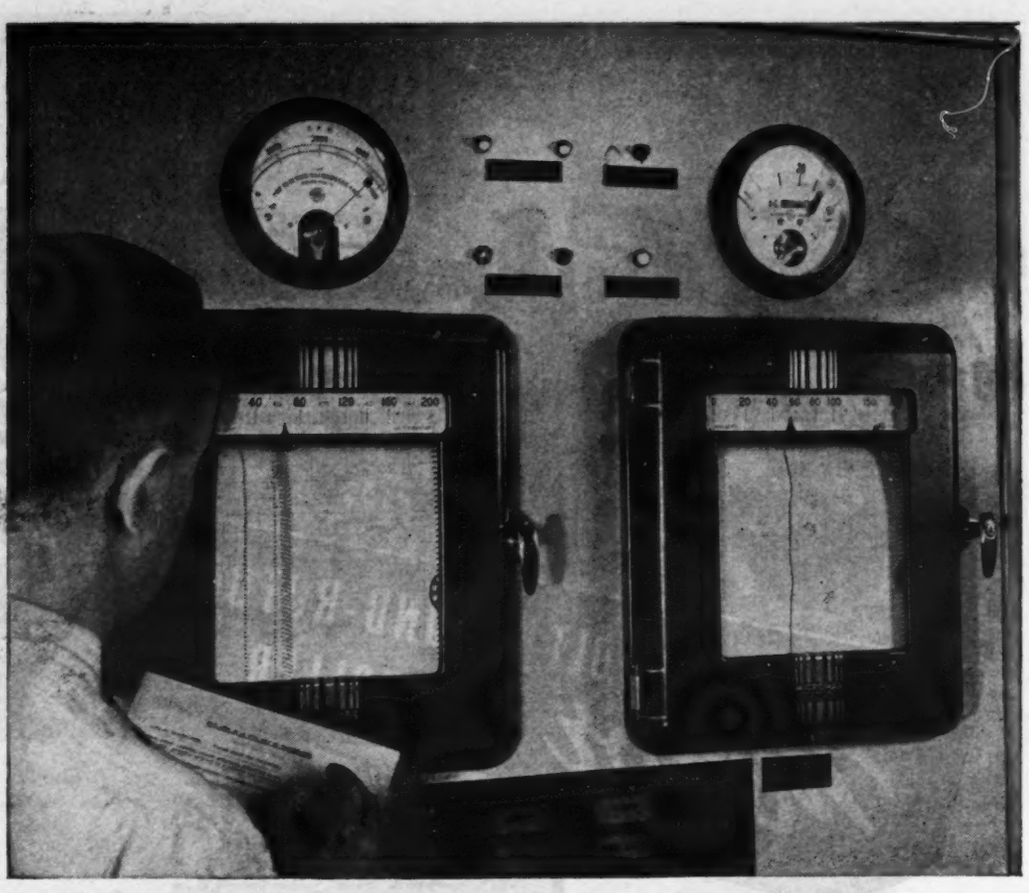
CORNING *means* Research in Glass

Electronic Glassware

REG. U.S. PAT. OFF. CORNING

REG. U.S. PAT. OFF. PYREX

"PYREX" and "CORNING" are registered trade-marks of Corning Glass Works



Micromax Recorder at left shows temperature of 6 points in stator, and also of exciter air and outlet water of the hydrogen cooler of generator. Recorder at right shows temperature of the field. Watching these 9 temperatures is essential when carrying heavy load, though Recorders will also sound alarms if any one temperature exceeds a predetermined point.

"OVERLOADED" GENERATORS
Need This Micromax Field & Stator Protection

Loading of electrical generators on the basis of the temperatures of their stators and rotors is a practice which many power companies are now planning to use. Special tests have been outlined* to determine the amount of load which may be added, under specific conditions, to that given as maximum on the nameplate. Here are some of the factors to be considered:

1. Each generator is a separate problem.
2. Nameplate data may provide unnecessarily large safety factor for load swings, unbalanced phases, etc.
3. Ambient temperature may be less than nameplate specifies.
4. Power factor may be higher than specified.
5. Change in terminal voltage may permit greater output.
6. When starting from low temperature, a generator can carry short-time excess load because of its own temperature lag.
7. In emergencies and for short peaks it may be more economical to operate at extraordinary temperature and thus age the insulation at an abnormal rate, rather than to provide the additional rated capacity for short-time loads.

When a generator is loaded on the basis of temperature, we can supply its operator with complete temperature readings by means of two instruments—a Micromax Stator Temperature Recorder and its companion, a Rotor Recorder.

The Stator Recorder shows the temperature of 6 points, and of incoming and outgoing cooling medium. It sounds an alarm if a peak temperature is reached.

The Rotor-Temperature Recorder measures the resistance of the entire field and records it as temperature. Devised about 15 years ago, it has been less used than the Stator Recorder, for the reason that not every generator normally needs both instruments. As load becomes abnormal, or unfavorable power factor conditions occur, however, this instrument has come increasingly into use and under present-day conditions is rapidly becoming standard equipment for large generators.

Both instruments are described in Catalog N-33-161, available on request. If you have a specific instrumentation problem in mind, please describe it and an L&N engineer will gladly try to help solve it.

Jrl. Ad. N-33-161(5)

*From AIEE Miscellaneous Paper 43-93, "Interim Report on Emergency Measures to Increase Output of Generating Equipment and Systems", June 1943, available at 65¢ from AIEE, 33 W. 39th St., New York City 18.

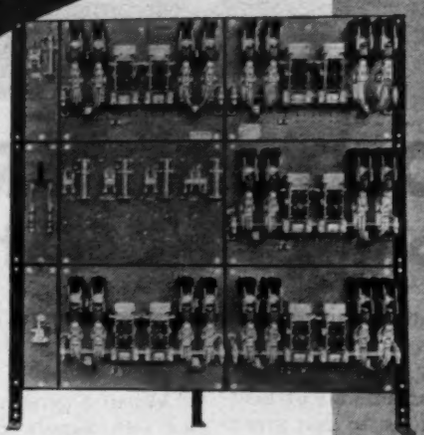
LEEDS & NORTHRUP COMPANY, 4938 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES

V depends on me!
A Slogan For Every American

EC&M 2300 VOLT WOUND-ROTOR *Motor* CONTROLLER



For 2300 volt, wound-rotor motors, EC&M Non-reversing or Reversing Control is without equal. And for the primary, high voltage switching requirements, Type ZHS Magnetic Contactors are used.

These contactors are of compact design and oil-immersed, with the control circuit potential transformer, in a single shock-proof enclosure. For reversing applications, as used on this 18-inch mill, two contactors are mounted back-to-back with heavy, mechanical interlock-bar between them and enclosed under oil in one tank.

Panels for controlling the secondary, or rotor, circuit consist of *LINE-ARC* Contactors and Frequency Acceleration Relays. Type NX Master Switch gives speed control.

Specifications of these EC&M Wound-rotor Motor Controllers are given in Bulletins 1062-C, 1140-B, and 1182-2. Write for your copies.

OUTSTANDING FEATURES of EC&M 2300 Volt Magnetic CONTACTOR CONTROL

1 *Heavy-duty, mill type, 2300 volt contactors—mounted under oil in one enclosure with positive interlocks for separating the circuits.*

2 *LINE-ARC magnetic contactors for control of secondary circuits have low upkeep cost, high arc-rupturing ability.*

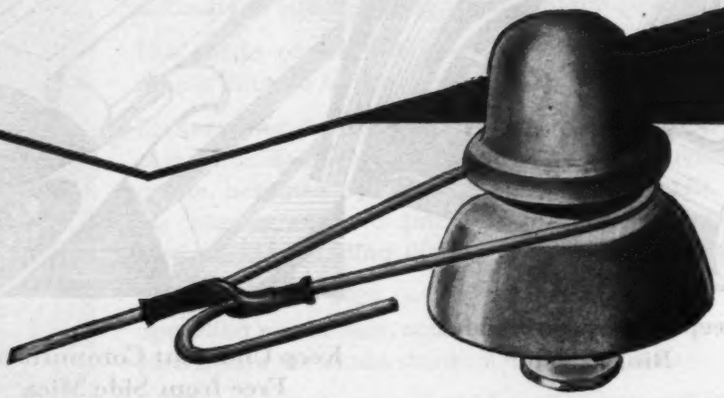
3 *FREQUENCY RELAYS govern rate of acceleration automatically—respond accurately to motor speed, increasing motor torque as required.*

4 *Potential transformer, self-contained in contactor enclosure, supplies 220 volts for control circuit.*

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79th STREET • CLEVELAND 4, OHIO

Nicopress OFFSET DEAD ENDS offer Many Advantages



1 They are designed for use on copper, Copperweld and Copperweld-copper conductors.

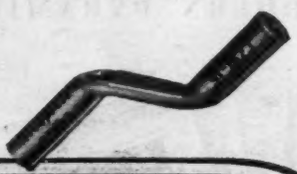
2 They can be installed on Pin, Strain or Spool insulators.

3 Simplicity and speed of installation.

4 Strength and tightness.

5 Provide for a tail of any desired length.

6 No extra tools are required to make the offset dead end as the same tool used in making regular line splices will do the job. These convenient Nicopress Tools are small and compact and are extremely easy to operate close to the insulators or cross arms.



The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr. — N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor — INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

The B A C of Good Commutation and Electrical Machine Performance

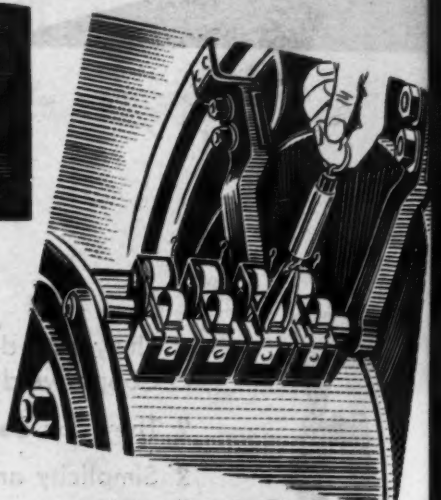
● Serious shutdowns and consequent delays in the production and delivery of urgently needed materials can be avoided by observing these simple precautions in the maintenance of motors, generators and converters. Under present conditions, dependable and uninterrupted performance of electrical power equipment is of utmost importance. Keep your machines in readiness to deliver full output at all times.

Keep Commutators and Rings Clean

Cleanliness is of paramount importance in the continuous operation of brush-using equipment. Time spent on keeping commutators, rings, brush holders and rigging free from dust, dirt, oil and film pays dividends. Use a suitable canvas wiper frequently on commutators and rings. Keep them clean and keep them running.

Keep Undercut Commutators Free from Side Mica

Thin edges of mica along the sides of slots of undercut commutators are a frequent source of trouble. Special care should be taken to inspect each slot carefully and to remove all side mica when undercutting commutators. Bad sparking and serious commutator burning can be avoided by observing this precaution.



Keep Brush Pressure Uniform and Correct

The spring pressure applied to brushes has a marked influence on brush performance. Equal distribution of current among all brushes requires that the pressure on all brushes be kept as nearly equal as possible. Check brush pressure frequently and adjust it to compensate for brush wear. Use pressures recommended for the grade of brush and class of service in which it is used.

MODERN PYRAMIDS will tell you more

This series of bulletins contains practical information on Commutation, Brush Operation and Machine Maintenance to help conserve present equipment and to keep it in continuous and efficient operation. If you are not receiving these bulletins write us direct or contact your National Carbon representative.

The services of our engineering staff are available for the proper selection and application of "National" Carbon Brushes on all types of equipment and for every class of service.

Keep your eye on the infantry . . . the doughboy does it!

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

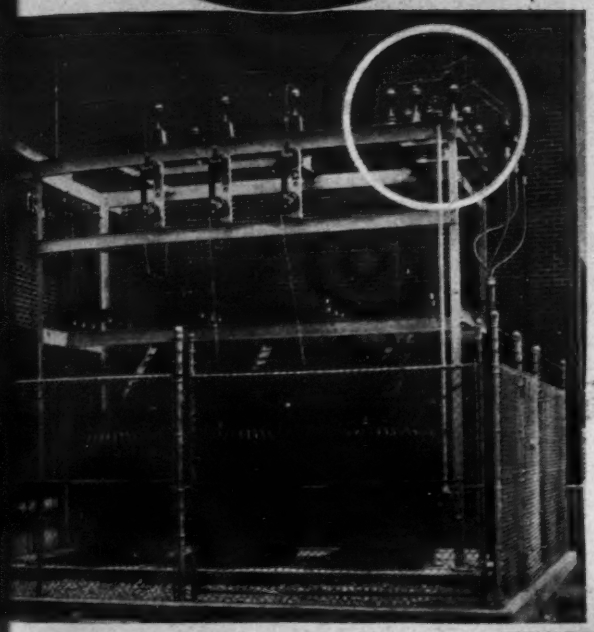
UCC

GENERAL OFFICES: 30 East 42nd Street, New York 17, N. Y.

DIVISION SALES OFFICES: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

"THREE E" 8400 TYPE AIR BREAK SWITCH

CLEAN, POSITIVE CONTACTS EASY TO OPERATE!



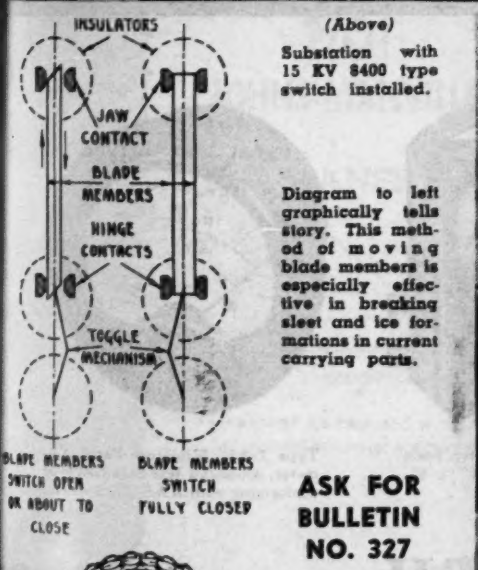
In designing Type 8400 we have accomplished EASE OF OPERATION as well as *clean positive contacts.* This is important particularly where sleet, ice, and dirt accumulate. At present you may have switches with good contacts but there is that ever present bugaboo of difficulty in opening because of contacts being too tight.

The action of the 8400 switch blades involves but a simple change in blade position to establish pressure.

Blades enter the contact jaws in the "collapsed" form of a parallelogram. In closing, a powerful toggle mechanism, actuated by the rotating insulator stack, forces the blades outward into positions approximating a rectangle, expanding them against the jaw contacts.

In opening the 8400 switch, the first movement of the operating mechanism completely releases contact pressure before the blade starts its upward travel.

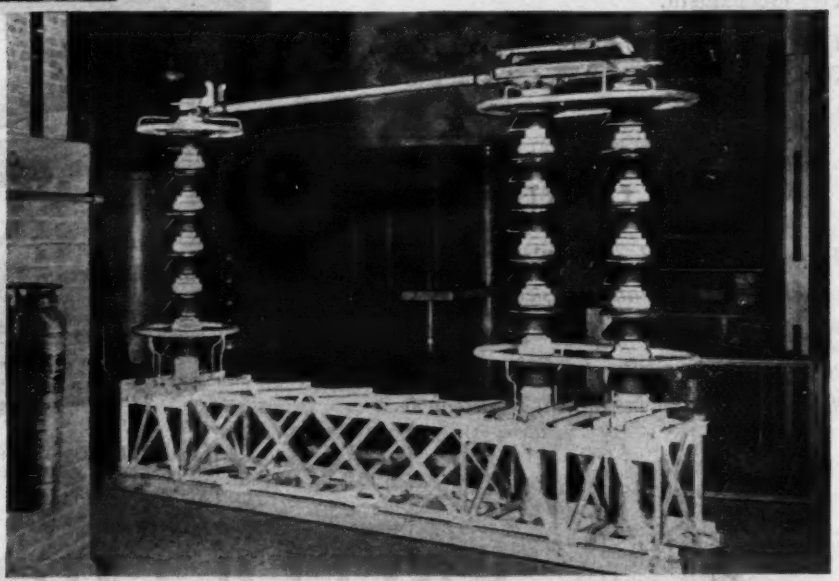
8400 type switches are built for all voltages 7.5 to 287 kilovolts and for current ratings up to 4000 amperes.



(Above) **Substation with 15 KV 8400 type switch installed.**

Diagram to left graphically tells story. This method of moving blade members is especially effective in breaking sleet and ice formations in current carrying parts.

ASK FOR BULLETIN NO. 327



Single pole of 230 KV 1200 ampere 8400 type switch, being made ready for test.

THREE E — ELECTRICAL ENGINEERS EQUIPMENT CO. — MELROSE PARK ILLINOIS

A PORTABLE TESTING INSTRUMENT WITH NO PROJECTING PARTS

ROLLER-SMITH TYPE NP . . .

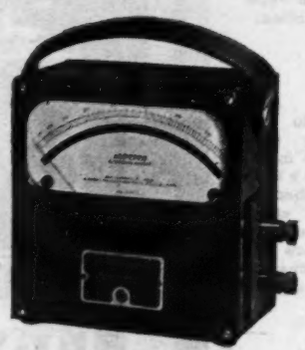
Roller-Smith Type NP Portable Testing Instruments are designed for general service where a highly accurate and extremely rugged instrument is required. The case is made in two parts: an outer walnut case and an inner two-piece metal case. This construction furnishes full magnetic shielding, protects the mechanism from external strains, and the movement from dust and moisture. The lid of the instrument is designed to completely cover the dial and all binding posts, so that when closed there are no projecting terminals or other parts. The window is of maximum area for high dial visibility; scale length is 5¼". Instruments are 8" square by 5½" in depth and weigh approximately 7 pounds. Ratings cover a broad range of testing requirements.

Roller-Smith Type NP Instruments are supplied in single or multiple ranges for the measurement of direct current in milliamperes, amperes and volts, and alternating current in amperes, volts, watts, power factor and frequency. D-c instrument mechanisms are permanent magnet moving coil (d'Arsonval) type; a-c ammeters utilize a repulsion iron-vane mechanism and all other a-c instruments, an electro-dynamometer mechanism.

Catalog 4340 contains complete description and full information with prices. Write for a copy.

OTHER R-S INSTRUMENTS

Panel, switchboard and portable instruments of practically every standard size, shape, capacity, type and style are included in the R-S line of electrical instruments. Let us quote prices and deliveries on your instrument requirements.



"Steel-Six" Portable Ammeter. Scale length 5 3/16". Size 6" x 6" x 4". Accuracy ½ of 1%.

Type T-3.5" Miniature Panel Ammeter. American War Standard type conforming with AWS C39.2—1944.

ROLLER SMITH

Sales Representatives in all Principal Cities

ROLLER-SMITH BETHLEHEM, PENNA.

Canadian Plant: ROLLER-SMITH MARSLAND LTD., Kitchener, Ontario

STANDARD AND PRECISION ELECTRICAL INSTRUMENTS • AIRCRAFT INSTRUMENTS • SWITCHGEAR
AIR AND OIL CIRCUIT BREAKERS • ROTARY SWITCHES • RELAYS • PRECISION BALANCES

FOR LASTING, DEPENDABLE SERVICE...

rely on these 6 advantages of Transite Ducts

Inorganic . . . made of an asbestos and cement composition compressed under great pressure. This provides permanence and strength. These ducts are also immune to rust and rot.

Permanently smooth bore . . . long cable pulls and replacements are made easier. Danger of damage to cables is minimized.

Easily and quickly installed . . . long, light-weight lengths and simple assembly method assure rapid, economical installation.

Immune to electrolysis . . . being entirely inorganic and non-metallic, these ducts are not affected by electrolysis or galvanic action.

Lower cable temperatures . . . an advantage resulting from a relatively high rate of heat dissipation.

Incombustible . . . won't contribute to the formation of dangerous smoke, gases, or fumes. If burnouts do occur, these inorganic ducts provide maximum protection to adjacent cables and permit easy removal of damaged conductor.

For complete details on Transite Ducts, write for Data Book, DS-410, Johns-Manville, 22 East 40th Street, New York 16, N. Y.

JOHNS-MANVILLE *TRANSITE DUCTS*

TRANSITE *CONDUIT*

Designed for exposed work and for use underground without a concrete encasement.

TRANSITE *KORDUCT*

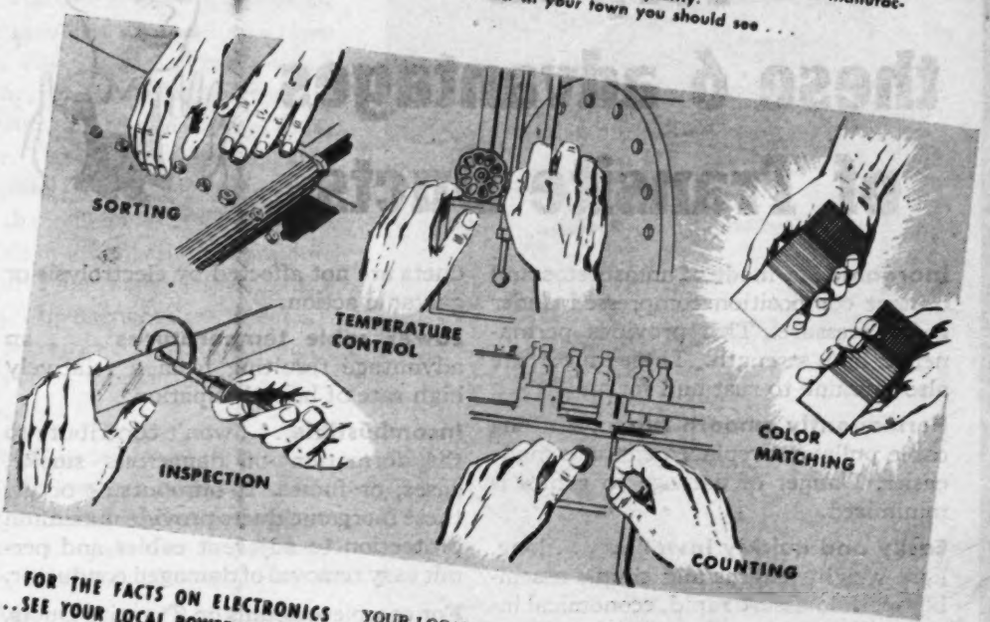
For use in concrete. Thinner walled, otherwise identical with Transite Conduit.

How Many HANDS *Are Wasted?*

In the illustration below five pairs of hands are busily engaged in five typical factory operations. Each instance is an example of *waste labor!* Electronic equipment can do these jobs faster, cheaper, more accurately—and release those hands for *more productive labor*—with the end result of lower production costs . . . lower consumer prices . . . more output—and *more jobs!*

These are no dreams of an Utopian electronic future. They are hard realities in war-busy plants today. Countless other applications—including those shrouded in military secrecy—show where and how the science of electronics will help postwar manufacturers boost *low-cost* production and better product quality.

If you're interested, there is a man in your town you should see . . .



FOR THE FACTS ON ELECTRONICS ...SEE YOUR LOCAL POWER COMPANY

YOUR LOCAL UTILITY pays for the services of a skilled electrical engineer, abreast of the latest electronic developments, to help you solve many production problems. He's the man who can help you determine *where* and *how* electronic equipment can profitably be put to work in *your* plant.

His *specialized*, experience-sharpened "know how" is yours for the asking—without obligation... his company profits through your use of the power required to activate electronic devices.

And—when Victory brings modernization day to hand—we hope you'll remember Roebling. The wire specialists. A single source of all wires and cables for the electronic cost-cutters, better lighting, better air conditioning and better power distribution methods the war has evolved.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

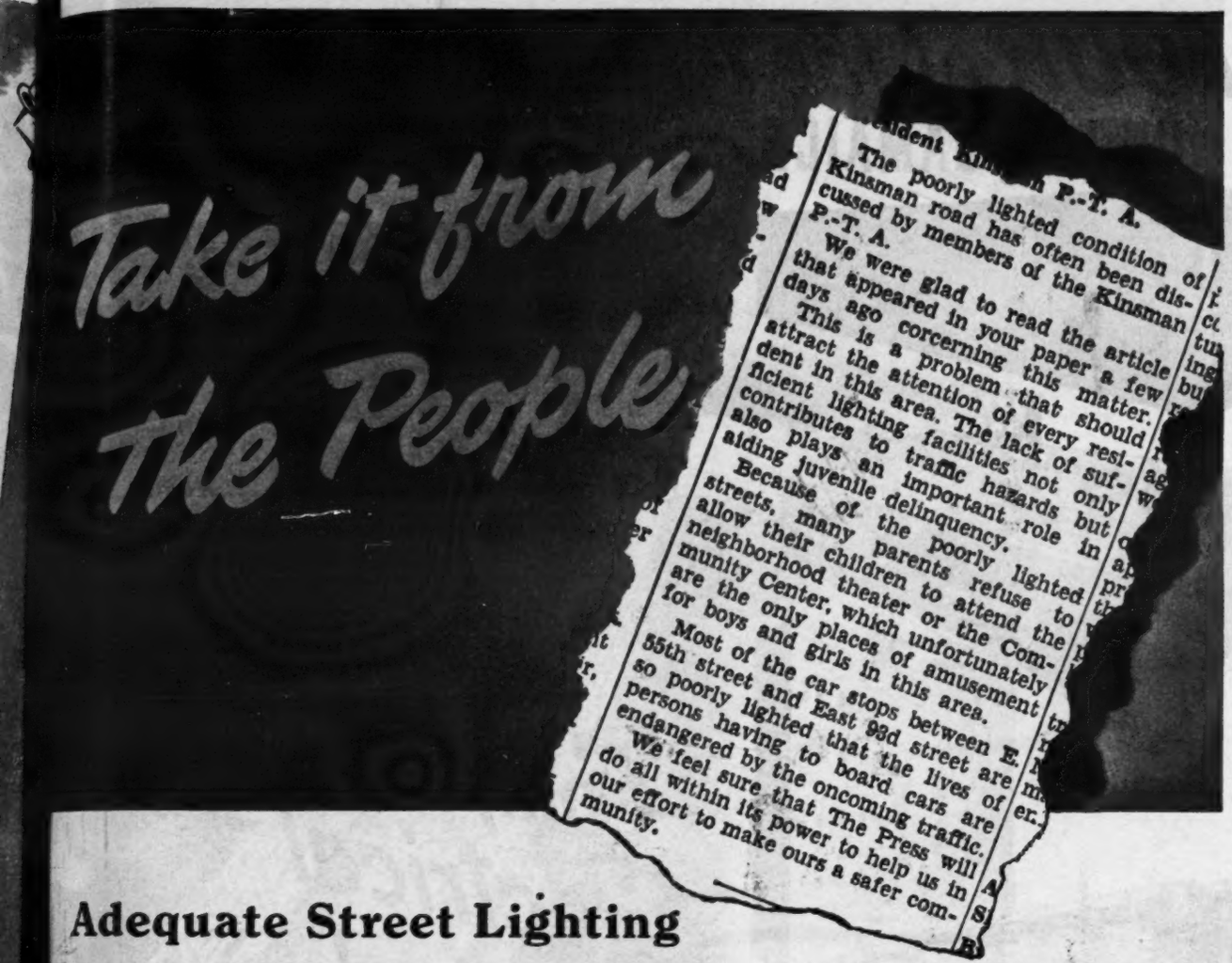
JR ROEBLING

ROEBLING
PACEMAKER IN WIRE PRODUCTS

Wire Rope and Strand • Fittings • Cold Rolled Strip • Aircord, Swaged Terminals and Assemblies • Round and Shaped Wire Wire Cloth and Netting • High and Low Carbon Acid and Basic Open Hearth Steels Suspension Bridges and Cables • Electrical Wires and Cables • Aerial Wire Rope Systems

WHEN INDUSTRIAL LOAD BUILDING becomes a problem again, we hope these 1944 Roebling messages will have helped to pave the way for your efforts. This advertisement is appearing in current issues of *Mill & Factory* and *Purchasing*, carrying the Electronic Utilization message to 39,569 industrial executives.

REPRINTS of the advertisement available on request


Take it from the People
P.-T. A.
The poorly lighted condition of Kinsman road has often been discussed by members of the Kinsman P.-T. A.
We were glad to read the article that appeared in your paper a few days ago concerning this matter.
This is a problem that should attract the attention of every resident in this area. The lack of sufficient lighting facilities not only contributes to traffic hazards but also plays an important role in aiding juvenile delinquency.
Because of the poorly lighted streets, many parents refuse to allow their children to attend the neighborhood theater or the Community Center, which unfortunately are the only places of amusement for boys and girls in this area.
Most of the car stops between E. 55th street and East 93d street are so poorly lighted that the lives of persons having to board cars are endangered by the oncoming traffic.
We feel sure that The Press will do all within its power to help us in our effort to make ours a safer community.

Adequate Street Lighting Can Build Public Good Will

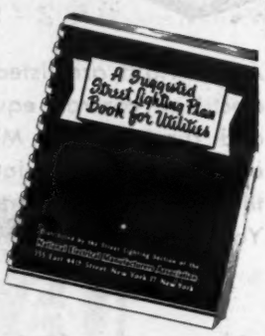
JUST read what one prominent citizen had to say recently:

"The lack of sufficient lighting facilities not only contributes to traffic hazards but also plays an important role in aiding juvenile delinquency . . . parents refuse to allow their children to attend places of amusement . . . the lives of persons having to board cars are endangered."

Yet this is only one of *thousands* of complaints from people in towns and cities all over the country. Today they're *really* awake to the pressing need for better street lighting.

Listen to them before their complaints become *demands.* Identify yourself with a public service that promotes the welfare of the community. Sponsor a postwar street lighting program adequate for the needs of the people.

For your free copy of this new book which was published to help you capitalize on the good will building possibilities of good street lighting, write The Street Lighting Section, National Electrical Manufacturers Association, 155 East 44th St., New York, N. Y.



Good Street Lighting Builds Good Will

FOUR of the 18 METROPOLITAN SWITCHBOARDS IN THE JAMAICA SEWAGE DISPOSAL PLANT

At the right are listed various types of electrical control equipment designed and furnished by METROPOLITAN for utilities, industrial plants, large mercantile establishments, and public buildings. Your inquiries are invited.

Knife Switchboards
Circuit Breaker Switchboards
Dead Front Switchboards
Battery Charging Switchboards
Motor Control Switchboards
Explosion-proof Switchboards
Laboratory and Test Switchboards
Control Switchboards
Generator and Distribution Switchboards

METROPOLITAN ELECTRIC MFG. CO.

ESTABLISHED 1892
METROPOLITAN
TRADE MARK
ELECTRIC LIGHTING AND POWER DISTRIBUTION EQUIPMENT

GENERAL OFFICES: LONG ISLAND CITY, N. Y. FACTORIES: LONG ISLAND CITY, N. Y., & WEST WARREN, MASS.

FLOOD ... one of many public hazards public utilities face and fight

... and one of the reasons why public utilities need radio!

THE continuity of electric light and power service today is so absolutely necessary to public safety and welfare that public utilities need every aid in restoring service and order in the shortest possible time after disaster strikes.

That is why they want radio. Modern 2-way RCA radio equipment on public utility trouble trucks, in power stations and substations, in public utility shops and offices, facilitate as nothing else can the instant transmission of emergency orders.

RCA Emergency Communications Equipment engineers will help you plan an efficient, modern emergency radio system for your requirements, to be installed postwar. AM or FM—RCA makes *both*. Now is the time to investigate this much-needed improvement to your public service.

BUY WAR BONDS AND KEEP 'EM

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION CAMDEN, N. J.

LEADS THE WAY... In Radio... Television... Tubes... Phonographs... Records... Electronics

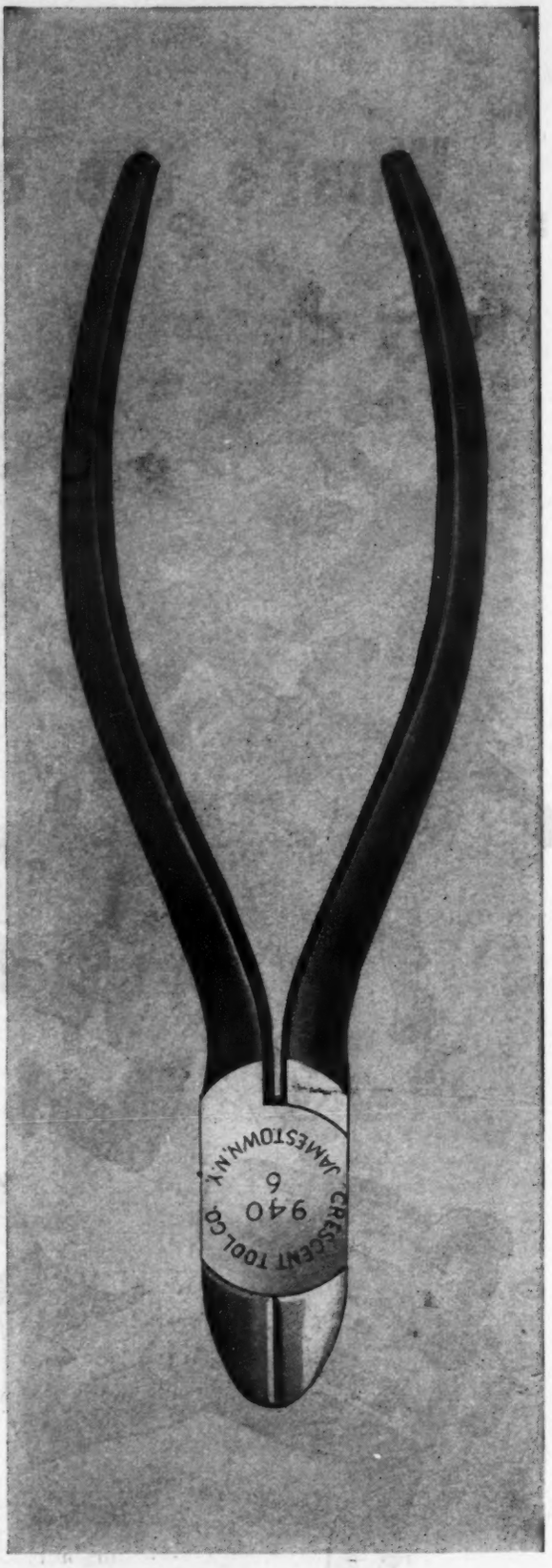
THIS is about a little experiment we performed with a 40 gauge Chromel-A wire, which is not much coarser than the hair of your head. We wanted to find out what would happen to a wire so fine, if it would be heated to 1800 Deg. F., say, by passing a current through it. . . . If you didn't know how durable Chromel-A is as a heating element, you'd think that this .0031" dia. test wire, so treated, would just about vanish, while you watched. Actually, however, this 40 gauge Chromel-A wire, just suspended as a loop, has now run for 888 hrs. at 1800 Deg. F. How much longer it will last, we don't know. It's already lasted long enough to prove the tough durability of Chromel-A, in the heavier sizes used in the heating devices you sell as a dealer, or as a maker. It likewise proves the lasting quality of Chromel-A in electric ranges and industrial units.

Chromel
NICKEL CHROMIUM
HOSKINS CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

HOSKINS MANUFACTURING CO., DETROIT 8, MICHIGAN

OST-WAR MECHANICS WILL VANT THESE WAR-TESTED

Crestoloy Pliers



Representative of the better tools which American industry and Mechanics will have post-war, is this improved Crestoloy Diagonal Cutting Plier.

No. 940-6 was developed just prior to the war to meet the severe requirements of the Air Corps. It is a light-weight, heavy-duty cutter, with generous handle leverage and stubby nose, providing clean, easy cutting right at the cutter ends.

The experience we have gained in making millions of them has resulted in design perfection which normally would not be attained in many years of peacetime production.

Today the whole output of this improved tool must necessarily go to our *fighting* mechanics: tomorrow they will be available for mechanics everywhere.

CRESCENT TOOL COMPANY, JAMESTOWN, N.Y.

What's the Rush?

It's the telephone rush. Every night thousands of service men and women dash to the nearest telephones to talk with families and friends at home. Most of the Long Distance calls from camps and naval stations are crowded into a few short hours.

Many circuits are likely to be crowded at that time and it helps a lot when you "give 7 to 10 to the service men."

BELL TELEPHONE SYSTEM

"798...799...800...Impossible!"

is is a welding tip.

At every weld, it creates a minia- inferno of blazing white heat. carries heavy surges of electrical rrent, so intense that the result- heat will "melt" or fuse two ces of metal together.

In the spot welding of aluminum, s intense heat has often made it cessary to stop production and ss or replace the electrodes as quently as every 30 welds. Now, however, by cooling the electrodes with a refrigerated liquid, it is sometimes possible to make as many as 800 welds before it is necessary to dress or replace the welding tips... another amazing application of G-E industrial refrigeration!

Many, many other new and improved techniques in refrigeration and air conditioning are helping industry do the "impossible" in war production today. They'll all be available, and *ready* for any commercial or industrial application after Victory.

To place your name high up on the preferential list for earliest available data on finer postwar air conditioning equipment, write *now* to: *General Electric Company, Air Conditioning and Commercial Refrigeration Divisions, Section 447, Bloomfield, New Jersey.*

☆ BUY WAR BONDS ☆

Industrial Refrigeration by

GENERAL ELECTRIC

the General Electric Radio Programs. The "G-E ALL-GIRL ORCHESTRA," Sundays, 10 p. m., EWT, NBC..."THE WORLD TODAY" News, Every Weekday, 6:45 p. m., EWT, CBS

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☆ BUY WAR BONDS ☆

Industrial Refrigeration by

GENERAL ELECTRIC

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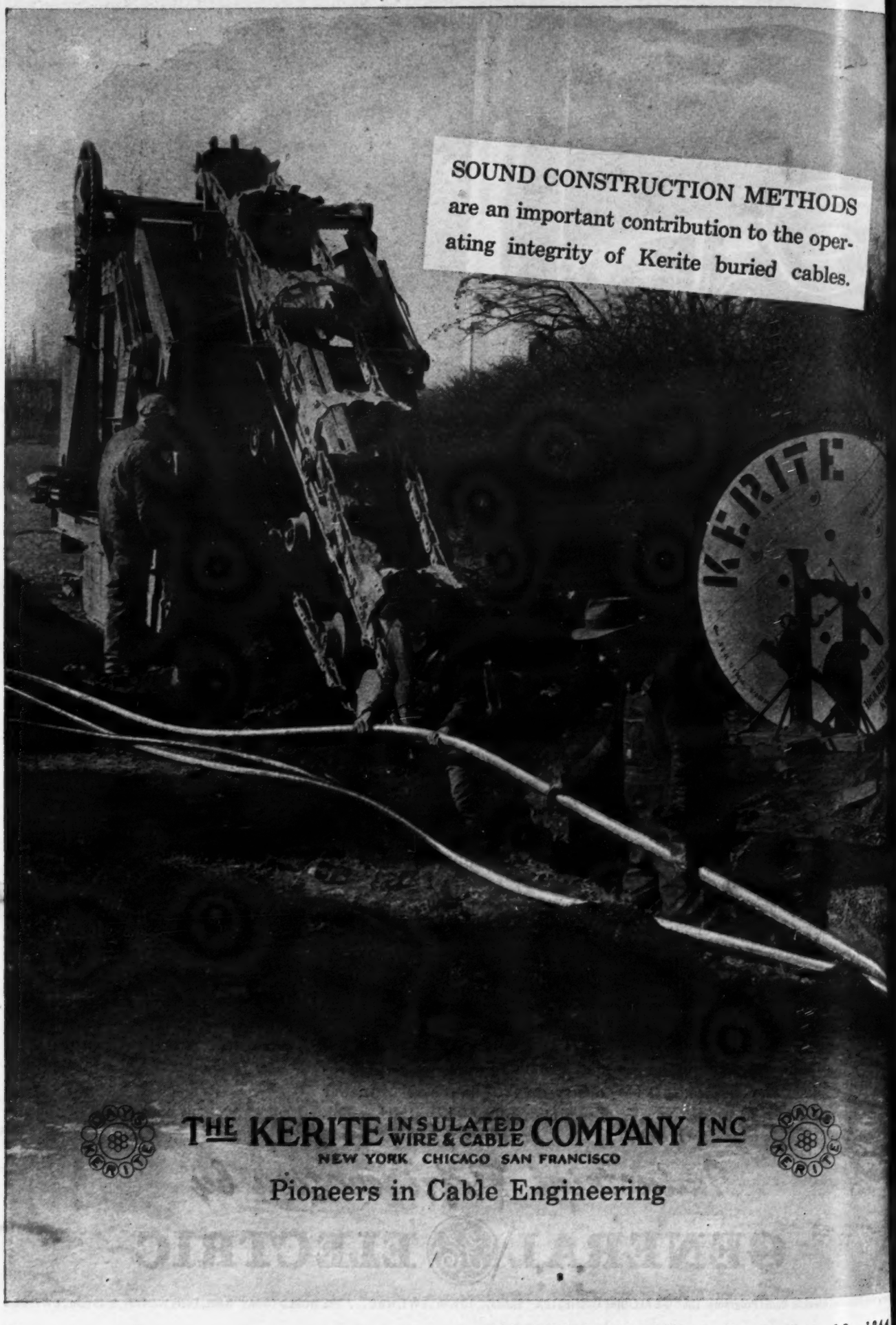
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Electrical World

September 16, 1944

When War Controls Are Removed

ANNOUNCEMENT LAST WEEK by the acting chairman of WPB that all controls not needed for war production to beat Japan would be removed immediately upon the defeat of Germany implies much more than the mere fact that materials will be freely available soon.

Within three months after the defeat of Germany, the announcement states, there will be a reduction of about 40 percent of war production which will free over 4,000,000 workers. That there may be no impediment to speedy reemployment of these workers in peace-time production WMC states that it will drop manpower controls also when Germany is beaten.

The question that naturally arises from this sudden decision to drop all controls on X-Day is whether or not business is capable of returning abruptly to a free economy after such a long period of strict controls. Has business worked out its post-war plans to the point where they can be put into operation just as soon as war controls are removed so that there will be jobs for war workers and for the men who later will be released from service? Will business so regulate itself that the disorderly scramble for goods that marked the end of the last war will not be permitted this time to result in another depression two or three years hence?

While all of the post-war plans have by no means been completely buttoned up, there is enough indication that the electrical industry wherever it is the work initiating agency will be ready to do its part in reabsorbing war workers when controls are removed. This will be true of construction expenditures to provide electric service and of the sale of load-building equipment which is expected to have more impetus placed behind it than ever before.

In fact, the greater problem, immediately at least, is more apt to be that of supplying the demand than of re-employment.

Many sectors of business had been hopeful that some form of WPB control would continue at least over the first rush for civilian supplies. With these controls no longer available, the manufacturers may have to resort to allocations and refuse to accept excessively large orders.

It is going to be a very difficult time with everybody hungry for materials and supplies of all kinds and extremely eager to get back to normal operations. The manufacturers can be expected to do their best to supply their customers but until the first rush is over buyers must be considerate, especially those purchasing for large organizations. Already small companies are beginning to be fearful that they may have to wait until the large fellows are served. If anything like this happens there is bound to be a demand for a return of government controls, which once restored may last for a long time.

Inventories will need replenishment but that can be done gradually, especially when there is no indication that price ceilings are going to be removed and there, therefore, is no speculative advantage. Materials for construction projects do not all have to be shipped at once. Deliveries should be specified in accordance with need. The restraint that is used in ordering supplies and equipment after controls are removed will go far toward an orderly restoration of a free market and the assurance of the continuance of an unregimented economy.

Substation Designed for Urban Load Reliability

Star connection for 13.2- and 4.3-kv. buses with oil-poor and oil-less breakers for reliability—Supply circuits looped through isolating disconnects for economy—One-floor plan for ease of operation and maintenance of Cincinnati substation

M. S. SCHNEIDER, Engineer, Electric Construction Section, Columbia Engineering Corp., Cincinnati, Ohio

PRIME FACTORS governing the location and design of the Charles Substation were reliability, safety to personnel, investment cost, the use of as much existing equipment as possible, operating cost and possibility of future expansion. Although these factors are not new, it is believed that an unusually successful balance was reached. No factors were purposely overstressed with the possible exception of safety to personnel.

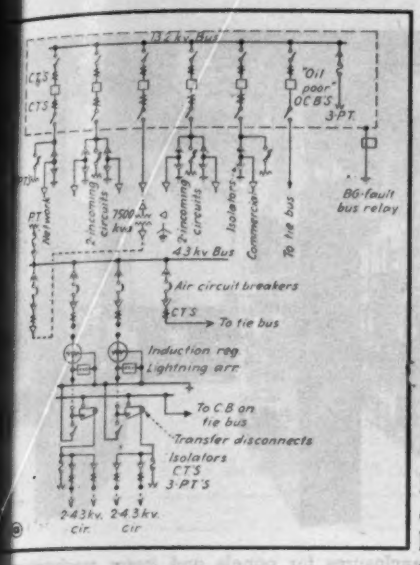
Necessity for increased distribution capacity had been apparent for several years. Study of the load requirements indicated that 60,000 kva. divided about evenly between the 4.3-kv. circuits and 13.2-kv. circuits was the greatest amount that should be supplied from this location. A load of this size might be supplied more economically at 66 kv. and the property was purchased with that in view. It is planned to loop an existing 66-kv. underground circuit through Charles Substation and the present 13.2-kv. supply circuits would then become distribution circuits. The substation supplying this load was over 30 years old and hazardous so it was highly undesirable to add to it.

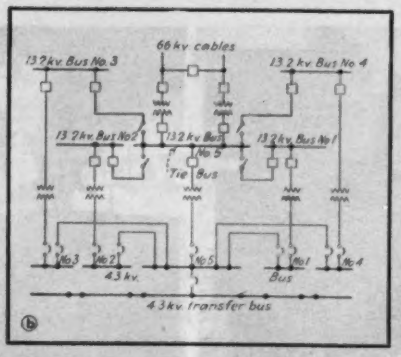
NEW AUTOMATICALLY-CONTROLLED Charles Substation improves reliability of downtown business district supply and provides additional capacity for war loads. Load in the central area of Cincinnati is supplied by a 120/208 volt, three phase, 4-wire a.c. underground network system and a 120/240 volt d.c. Edison system with a density of approximately 50,000 kw. per square mile. The customers in this area consist of the usual large office buildings, theatres, hotels, hospitals, and public buildings. Immediately surrounding this central zone is an area with an average load density of 10,000 kw. per square mile supplied by 2400/4150 volt, three phase, 4-wire circuits or 13,200 volt, three phase, 3-wire radial circuits depending on the size of the load in the particular area served

A cost analysis indicated that property could be purchased and a new one story structure built for very little more than the cost of revamping the existing buildings to fit the proposed installation. This was particularly true for the future 66-kv. connection. It would have been difficult and costly to install the 66-kv. equipment indoors with the necessary ventilation and fire protection.

13.2 Kv.-Bus and Circuits

Use of single switching and the looping of the supply circuits through disconnects (Fig. 2ab) indicate that reliability and safety at a minimum expense were important considerations. Long experience with "oil-poor" breakers was the deciding factor in the choice of 13.2-kv. switchgear. These oil circuit breakers are live tank, cross-blast type rated 500,000-kva. and are metal clad, with interlocked 6 pst crank operated disconnects. Doors over the oil circuit breaker tanks are interlocked with the disconnect mechanism so that they cannot be opened unless the discon-

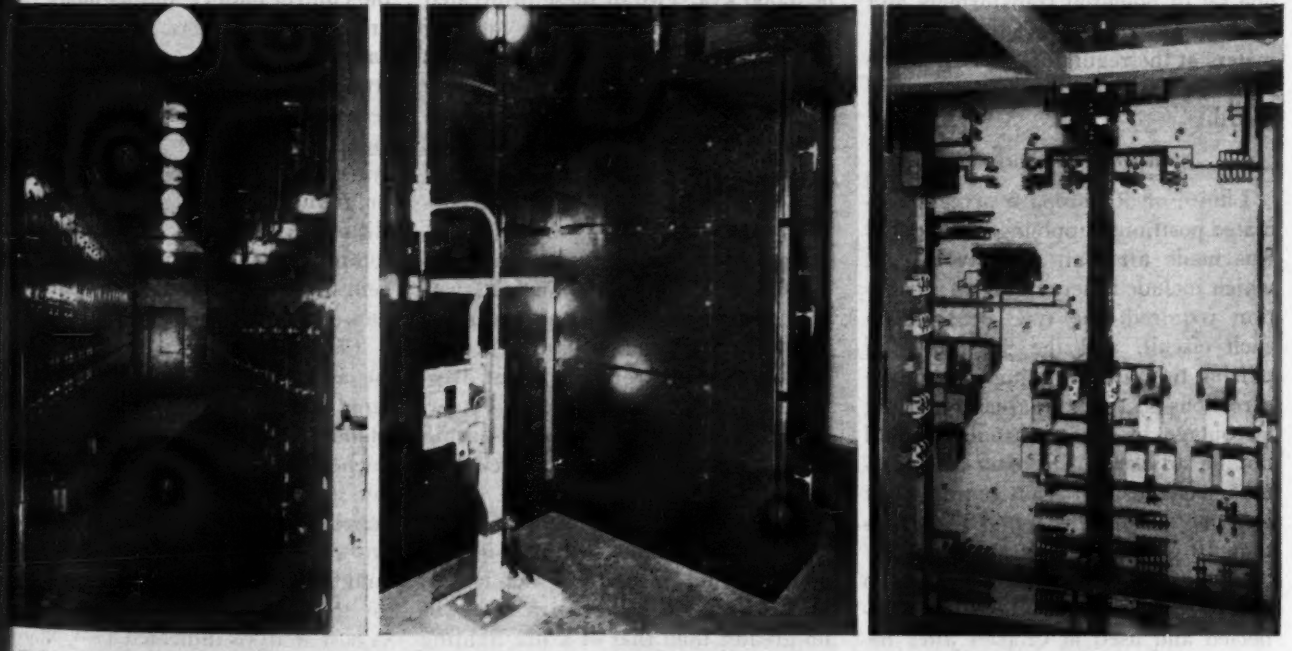




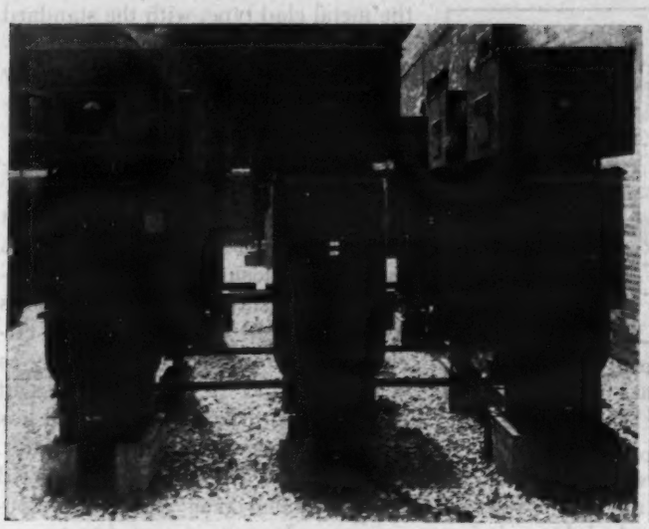
TYPICAL 13.2 kv. and 4.3 bus sections (a) and (b) simplified future bus connections

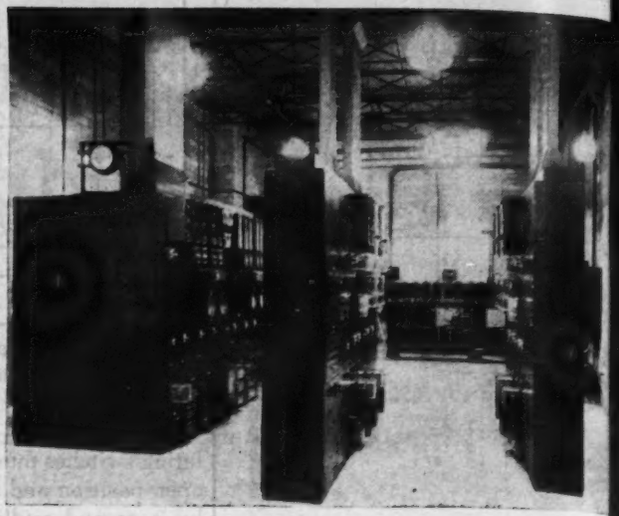
ects are in the full open position. All upply circuits are 13.2-kv. underround cables passing the site. Some f these formerly supplied suburban bstations but became unloaded when 66-kv. tie cable was installed. Comination isolating and grounding witches were installed across the isle from the circuit breakers in a etal enclosed structure which also ouses the potheads. These isolating nd grounding contacts are operated y a common handle so that the isolating switches must be brought to the open position and the handle released by a second padlocked lever before the contacts can be moved to the grounded position. The main lever is key interlocked with the oil circuit breaker disconnects and this key is released only when those disconnects are in full open position. The key can be removed from the isolating and grounding switch with the handle in any one of the three positions. This eliminates the possibility of operating these disconnecting devices under load but makes it possible to isolate one circuit and reenergize the other one of two circuits on a position.

The 4.3-kv. switch groups are of the metal clad type, with the standard disconnecting type Magneblast air circuit breakers and have all the safety features. They have a short-circuit interrupting rating of 150,000 kva. which is above the calculated duty. They are automatically reclosed after a fault and the reclosing relay is set for three reclosures in 2 minutes with the first reclosure having no intentional time delay. Air circuit breakers were chosen in preference to oil circuit breakers or air blast breakers as it was felt that they would be less of a fire hazard than the former and less of an experiment than the latter. Each of the 4.3 kv. circuits is of the bifurcated type where two 250-amp. circuits are connected to a common 500-amp. five percent buck and boost automatic induction voltage regulator and a 600-amp. circuit breaker. A common transfer disconnect is used to connect the circuits to a transfer bus when it is necessary to remove the regulator or circuit breaker from service. These eight circuits require about the same amount of equipment formerly used for four 250-amp. circuits, resulting in an appreciable saving. The line instrument transformers and isolators are in a separate structure. Each circuit has a separate isolating disconnect above the



THE 13.2-KV. BUS and pothead structure (left) with metal enclosed bus bar ties connecting the oil circuit breakers at the left with isolators and cable potheads at the right. Bus potential transformer end of 13.2-kv. section No. 3 (center); fault bus relay and disconnect at left; potential transformers and disconnecting fuses in pull-out type compartments. Each 13.2-kv. switch group is insulated from ground except at one end where the copper bar connected to all positions on that section is passed through a "BG" fault bus relay before it is connected to ground. The armored cable bus-tie connections to the common bus will have a separate fault bus relay which will trip all breakers on the two buses connected together at the time. Interior of 4.3-kv. control cubicle (right) showing wiring and overhead wiring trough





REBUILT INDUCTION REGULATORS (left) showing details of control panels and enclosures for panels and motor mechanism. Control room photographed with normal lighting (right). "Steelox" cable enclosures and supports (above cabinets) believed to be new application of this product. Cost analysis showed savings over other methods

potheads. The protective relays which trip the circuit breakers are connected to the common 500-amp. current transformer. Relays which operate annunciator drops and semaphores, are connected to 300-amp. current transformers on the individual circuits thus expediting the locating and isolating of the faulted circuit. These last mentioned current transformers also supply the recording ammeters. The two branches of the circuits have one set of potential transformers and these supply the contact making voltmeters at the regulators as well as the recording voltmeters on the switchboard.

Regulator Range

Choice of 500-amp., 5 percent regulated positions supplying two circuits was made after an extensive study, which included the amount of regulation required, the type of load on each circuit, and the possibility of pairing two circuits going in opposite directions so that the areas receiving an outage in case of trouble would not be adjacent. The over-all maximum voltage regulation required for any one circuit was found to be less than 10 percent so that existing 250/500-amp., 10/5 percent regulators in other substations could be reconnected and used at Charles after being replaced by the 250-amp. 10 percent regulators from the old substation, resulting in a saving in investment and critical materials. The 500-amp. regulators were of the indoor type but were rebuilt for outdoor service by the Electric Construction Department of The Cincinnati Gas & Electric Co.

Transformer Sizes

Size of the transformer banks was determined partly by an existing 7,500-kva. bank which was to be moved to Charles and partly by the practice of the operating company to keep the load of 4.3-kv. circuits below 80 percent of the regulator rating which, for 500-amp. regulators, would be 3,000 kva. Two of these bifurcated circuits would thus give a total of 6,000 kva. load and the use of this same 80 percent maximum load rule for the transformers resulted in the choice of 7,500-kva. transformers. Water-cooled transformers were chosen since the location of the substation was in an area where 13 deg. C well water could be obtained. This permitted a continuous load 12 percent above rating and also permitted the tying together of adjacent circuits in time of trouble without overloading the transformers. An emergency city water connection is available in case of a pump or well failure.

Three-phase transformers were chosen to reduce the cost. Non-inflammable liquid insulation was felt to be justified since the extra cost was no greater than that of a fire fighting system of the Mulsifyre type which would have been installed with oil-filled transformers.

Station auxiliaries, including the electric heat, are supplied by a 150-kva. self-cooled transformer insulated with Class B material, which permitted its installation near the dead front distribution cabinet in the utility room. A throwover switch transfers all load except a few of the heaters to the a.c. network in case of a power failure.

Control Room

For greater reliability in operation, all protective relays, reclosing relays, meters, instruments and control switches are located in an air conditioned control room containing also the control battery and its motor generator set (above). To facilitate locating the circuit or equipment in trouble, separate annunciators with separate master relays and indicating lights are installed for each section. An alarm device gives the dispatcher an audio signal that an abnormal condition exist and if this persists, an automatic substation supervisor is sent to the substation to learn the cause of the alarm.

Cable pans (above) are believed to be a new application of a standard product called Steelox. Preformed standard bent metal sections four inches deep, by twelve inches wide by ten feet long were used. Where more space was required pans were installed side by side. Special angles and tee connections were fabricated by the local supplier of this product. A cost analysis indicated a saving over pans made of flat sheets and angles or the use of iron conduit, beside giving a more pleasing appearance. Use as a common junction box and cable tray also affords support for a group of contactors used to control the electric heaters in the control room.

arallel Hot-Frame or Live Line Work

Two supplementary cross members support lift sticks to raise conductors vertically and individually by rope tackle

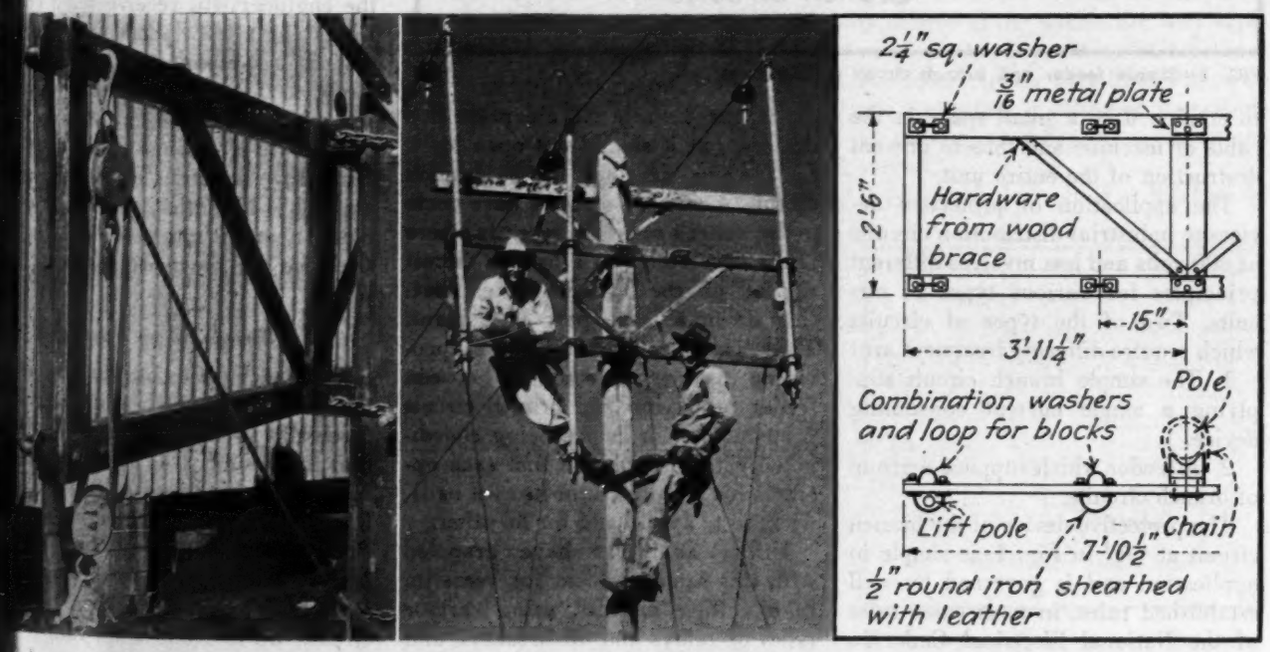
RITON BURR,* Central Power & Light Co., Corpus Christi, Tex.

R OVER TWO YEARS the Rice t Line crew of Central Power & ht Co. (Corpus Christi, Texas) used successfully a "Hot-Frame" -line maintenance tool which lifts conductors vertically and securely. as been used throughout an exten- e cross-arm replacement on about miles of 12-kv. 3-phase distribu- n lines with No. 2 and No. 1/0 SR on 300 and 400-foot spans. n operating with this frame the tomary crew in normal times is 4 emen, 2 groundmen, foreman and ver of light truck and trailer. One undman tends the fall lines of the hoisting blocks which are tied into snubbing rings on a boom chain near butt of pole. The other groundman and the driver send up material and tools and return them to the trailer. The foreman supervises and is responsible for the proper and safe conduct of the operation. Under exceptional or emergency conditions a crew consisting of one experienced lineman and one trustworthy groundman could safely change a good many cross arms in a day, as physical exertion and mental strain have both been greatly eliminated by this frame.

To replace a bad insulator, the lift pole is placed through the guides and tightened on the conductor. The blocks are attached, tie wires removed, and the conductor raised. The insulator is then replaced, the conductor lowered and tied, and lift pole and frame removed. To replace a cross arm the frame is installed, lift poles are attached to conductors, and strain is taken on all blocks before nuts and washers are removed from steel insulator pins. The insulators remain attached to the conductor and the pins remain in the insulators. When the new arm is installed the conductors are lowered and the steel pins guided into the pinholes, after which washers, nuts and Palnuts are installed with hot stick wrenches, and lift poles and frame are removed. Side strain on adjacent poles is eliminated altogether. No part of the steel pin is ever touched by hand, all removal and replacing of washers and nuts being performed with wood insulated tools. Attention is called to the special tool for guiding the pins into the pin-holes. This tool also holds square shouldered pins while the nut is being tightened. For the occasional round pin, a small pipe wrench can be attached to the universal pole head.

To use the frame on a single phase line built on standard 4-pin arms, it is rotated about 45 degrees until the outer guides are directly under the conductors.

* Rice Belt District Engineer.



TWO STRAIGHT-GRAINED oak members (left) are chained to the pole and carry guides for the lift poles. Rope tackle (center) raises each lift pole to elevate the energized conductors to safe working height above the cross-arm. Braced frame (right) comprises two horizontal members of 2 x 3½-in., two verticals 1¼ x 2½ inch, one vertical center member 1 x 6 inch and two braces 3½ feet x 1½ x 1½ inches, all straight grain oak. Design preferred to pipe and metal bracing used on other divisions

Fuses and Circuit Breakers in Industrial Plant Distribution

Problems of coordination of short circuit protection are troublesome because of lack of selectivity in available low-voltage protective devices—Needs in breakers explained

*L. C. PETERMAN, Electrical Engineer, Ford, Bacon & Davis, Inc., New York**

PROTECTIVE DEVICES are placed in all electrical circuits in industrial plants to protect against short circuits which interrupt production and overheat and damage cables, motors and other equipment. In a sense we cannot protect against short circuits, because the short circuit which opens a fuse or circuit breaker has already done some damage. The best we can hope to do is to localize the trouble quickly to confine it to a small space in the cable or machine and thus to prevent destruction of the entire unit.

The application of protective devices to industrial distribution circuits of 600 volts and less involves different principles for various types of circuits. Two of the types of circuits which require differing treatment are:

1. The simple branch circuit supplying a single current consuming device.

2. A feeder which supplies a group of branch circuits.

The protective device of the branch circuit at "A" in Fig. 1, is simple in application and is governed by well established rules, in most cases rules of the National Electrical Code. In general the trip rating of the protective device matches the rating of the wire, but the code does not distinguish between a time delay device which may permit a temperature rise of 10 deg. in the wire before opening and an instantaneous device which permits almost no heating of the wire.

The protective device in the feeder at "B," (Fig. 1) also is applied usually to match the current rating of the wire. It should open the circuit if a fault develops in the feeder conductor or in the branch circuit protective devices, but it should not open for a fault which develops in the branch circuit. A number of cases have come to the writer's attention recently where faults developing on a branch circuit tripped off the feeder breaker shutting down a large part of a plant. This brings up the problem of providing proper selectivity between feeder protection and branch circuit protection, each device being coordinated with the other so that each operates for a fault within its own bailiwick, so to speak, and for no other.

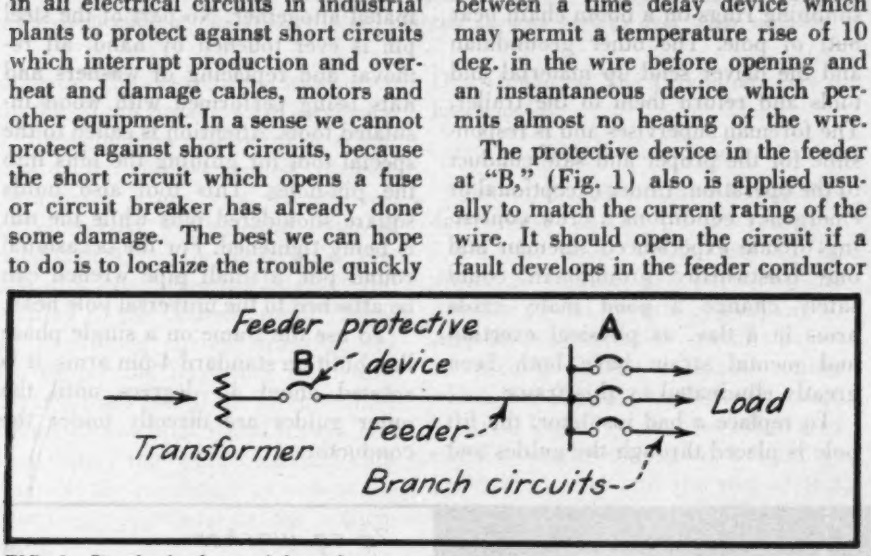


FIG. 1—Simple feeder and branch circuit arrangement

Utility engineers have grappled with this same problem for years on high voltage circuits, using various types of relays and oil breakers, and have achieved very great success in securing good selectivity. Yet in the low voltage field, where direct-acting breakers are available having inherently greater operating speed than a high speed relay and oil breaker combination, no real attack has been made on the problem of securing selective and adequate coordination. True, manufacturers are telling us to cascade breakers, placing big ones near the power source and little ones near the load so that when a heavy short shows up at the load, the whole plant trips out. That saves some money but in my opinion it is decidedly a "lame duck" way to protect a low voltage distribution system. I do not believe it is sound engineering. A shut down of the whole plant is to be avoided, if it is at all possible to do so. If it does happen, the operator or the engineer will receive scant credit for saving a few dollars on protective devices. The management is more than likely to forget the savings when a serious case of trouble develops.

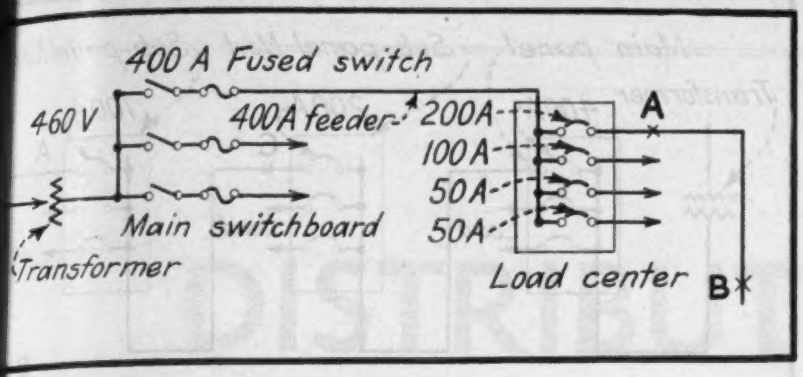
What to do about short circuits? Should we use fuses or circuit breakers and if the latter, shall we use the older type of magnetic tripping or shall we use the newer thermal tripping?

Breakers vs. Fuses

Without attempting to define all the advantages and disadvantages of fuses and breakers, it is to be noted that for circuits 600 volts and below fuses have for years held a predominant place as a protective device. Breakers always were favored for larger and important circuits but even here fuses have been used on circuits up to 2,000 amp. rating.

In my opinion, fuses are fairly satisfactory circuit interrupting devices. I do not subscribe to the thesis that fuses are wholly bad in industrial

* Adapted from AIEE Conference paper.



2—Thermal breakers backed up by fuses

nts and that they ought to be re-ced with breakers. Of course you e to use a little common sense and a little thought to their proper per application. But they are in-ensive, are usually available in bers' stocks, and permit consider-e latitude in feeder sizes without nge in fuse holders. The flexibil-of fuse application in some cases caused us to use fuses where we uld have preferred breakers. For mple, if you think you need No. feeders at the start of the job to find later you will require ,000 circ. mil you merely change s in the 400 amp. fuse holder, but the fuse holder itself. In the other ection, you can adapt 400 amp. clips to use 200 amp. fuses or n 100 amp. if you wish. Even if have to change fuse holders, the t is usually less than the cost of a trip unit for a breaker and very ch less than a new breaker.

The relative inflexibility of breaker plication as compared to fuses is a tty serious handicap to the former.

Thermal Breakers

A few years ago the small compact aker made its appearance—so all it can be built into ordinary ll-mounting panel boards. The in-try looked at them and generally proved but shied away because the ce was still much higher than fuses. en came the immense upsurge of w plant building. Money was avail-le to put in the best equipment and ddenly operators and engineers me to the conclusion that breakers re better than fuses and the indus-began buying the small panel unting breakers by the thousands. The two things operators like about eakers are (1) the ease of restor-service after a trip-out, and (2) duction in trip-outs due to over-loads of nominal amount or of short duration.

But the sudden wide use of the small panel mounted breakers led to some incorrect applications.

Take the case of a main switchboard with fused feeder switches. A new 400 amp. feeder is run to a new load center and a breaker panel board installed having 200, 100 and 50 amp. thermal breakers.

As cases of trouble develop the fuse back on the main switchboard sometimes opens and the breakers at the load center do not open. Doubt is cast on the quality of protection afforded by the breakers.

This is a problem in coordination The following characteristics of the equipment must be considered:

1. Although the short circuit current at the main switchboard may be easily 25,000 amp., short circuits occurring at a distance from the source of supply drop off in magnitude depending on the impedance of the circuit.

2. The time-current characteristics of fuses and thermal breakers differ widely.

3. For a current in excess of 10 times rating thermal breakers act instantaneously by reason of the addition of a magnetic trip which acts only at high values.

If the short circuit occurs at A, (Fig. 2) near the 200-amp. breaker at the load center the current flow might be 10,000 amp. The characteristic curves of the breaker show that it will open in about four cycles, but the fuse back on the main switchboard will open in about two cycles. Although these figures may not be exact, the fuse will undoubtedly open first under the conditions mentioned, completely defeating the purpose of the load center protection. If the short is at the end of a long feeder, such as B, (Fig. 2) the current flowing may be 1,500 amp. This will open the breaker in about five seconds, but the fuse carrying the 1,500 amp. plus 200 amp. of other load, will open in about four seconds (Fig. 3). Here again the 200-amp. breaker does not perform the function required of it.

In general, a breaker backed up by a fuse does not make a satisfactory installation.

Breakers Backed up by Breakers

Replacement of the 400-amp. fuse with a 400-amp. breaker will probably prevent some outages, but not all, for any short which develops 10 times the rating of the breaker, that is 4,000 amp., will cause both the branch breaker and the 400-amp. main breaker to trip simultaneously.

In another case one main distributing panel board equipped with the small thermal trip breakers feeds load in the immediate vicinity plus one large feeder to another panel at a distance (Fig. 4). Sub-panel No. 1 also feeds local load plus one large feeder to still another load center, sub-panel No. 2.

Here three breakers are in series rated 400, 200 and 100 amp. Note the following:

1. For any short circuits developing 400 amp. or more, all three breakers will trip out simultaneously.

2. A certain amount of selectivity is offered if the panels are well separated electrically, since the reactance introduced by the long lines will cause short circuits of different magnitude to develop at different points in the system.

For example, a short at B, (Fig. 4)

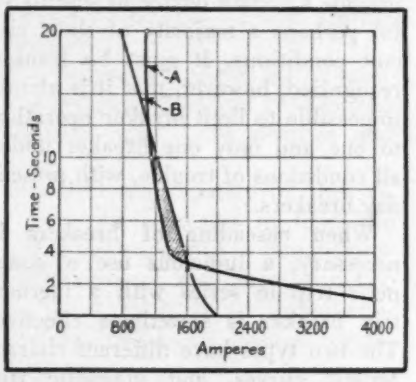


FIG. 3—Time-current curves of 400-amp. renewable fuse (A) and 200-amp. thermal breaker (B). Overcurrents falling within the shaded area will cause the fuse in the circuit to open before the breaker trips

at the end of the longest feeder of sub-panel No. 2 may develop only 800 amp. The characteristic curves of the breaker show that the 100 amp. breaker protecting this line will trip out in about five seconds. The 800 amp. current will not cause the 200 amp. back-up breaker at sub-panel No. 2 to trip because of the inherent characteristic of the thermal trip element, the tripping time being 2 seconds. This selectivity is the result of the short occurring at a favorable place in the system.

Coordination of Breakers

Suppose the short occurs immediately adjacent to the 100-amp. breaker at A, (Fig. 4). Here there is no long branch circuit to choke down the current. Suppose the short circuit current value is 2,000 amp. This is 10 times the rating of the back-up breaker so both breakers trip out simultaneously.

Likewise, if a short at C, (Fig. 4) close to sub-panel No. 1 develops 4,000 amp. or more, breakers at both main panel and sub-panel No. 1 will trip out simultaneously.

Cascading as above described should be avoided where possible. If it cannot be avoided, the following should be observed:

1. Limit the number of breakers in cascade in a single plant to two if possible, certainly to not more than three.

2. Keep the breakers well separated electrically to get the benefit of cable reactance.

3. Adjacent breakers in the cascade should differ in size by at least a 2 to 1 ratio and more if possible.

Following these simple rules will provide a certain degree of selectivity for perhaps a majority of short circuit conditions. It must be frankly recognized, however, that it is almost impossible to limit breaker operation to one and only one breaker under all conditions of trouble, with present day breakers.

When cascading of breakers is necessary, a judicious use of magnetic trip in series with a thermal trip breaker is sometimes effective. The two types have different characteristic curves, and magnetic trip breakers can be secured with much higher instantaneous trip ratings than can the termal breakers. But, the full magnetic trip is not available in the small panel mounted type.

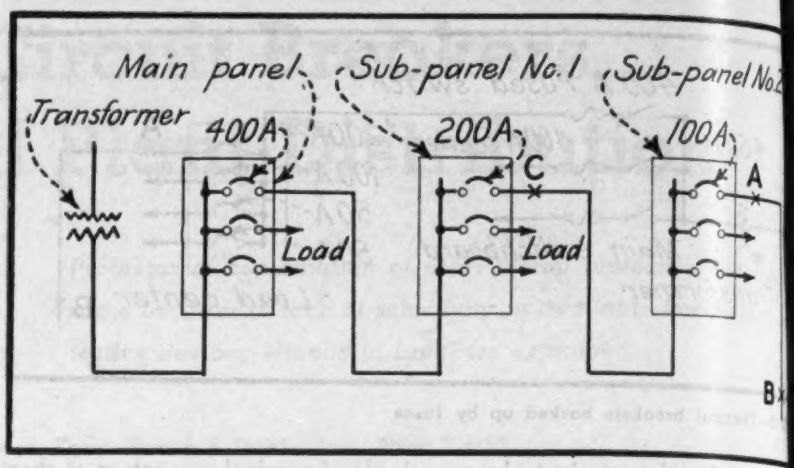


FIG. 4—Three breakers (400-amp., 200 amp., and 100-amp.) in cascade

The magnetic trip breaker is generally desirable where high trip settings are necessary. The thermal trip breakers have the advantage of permitting trip setting close to desired rating, at the same time not tripping out when motors having high starting current and long time acceleration are started.

With the recent adoption of the small panel mounting breaker in such great numbers, we should not lose sight of the advantage of the conventional type breaker, each in its own steel enclosure, or built up into a factory assembled switchboard. The conventional breakers rated at 15,000 amp. interrupting capacity are about the same price as the small panel mounted breakers. And do not lose sight of the fact that the larger breakers can be equipped with more auxiliary devices such as reverse current trip, extra auxiliary switches for interlocking, etc., that they have large wiring space, can be motor or solenoid operated if desired and can be had with thermal trip or magnetic trip. At the same price the big breaker is a better bargain, if space is available to install it.

Desirable Improvements

What do operators want in breakers that they do not now have? What can we reasonably look forward to in the future?

There has been a demand for auxiliary attachments for the small thermal breakers, such as shunt trip, overvoltage trip, bell alarm contacts, electrical operation, etc. and manufacturers have recently met this demand. These devices will make the thermal breakers still more useful, but we question the advisability of using an electrically operated mechanism on thermal breaker in an industrial application. We feel that such use would impose too severe operating conditions on the small breakers and make demands on their service reliability that can be adequately met only by the larger, conventional breakers.

Breaker Needs

The most urgent need at the moment is adjustable trip ratings in all types of breakers. When switchgear is bought for a new industrial plant the sizes of feeders are seldom known. If you buy 300-amp. breakers you are sure to wish later you had 400-amp. Maybe you change to 400 only to find that a few ought to be 600 amp. The 100-amp. breaker ought to be adjustable between 75 amp. and 100 amp., a 225-amp. breaker ought to be adjustable between 125 amp. and 225 amp., a 400 amp. between 250 and 400 amp. and so on. The field for breakers is limited until that can be done.

The next most urgent need is true and dependable selectivity coupled with high speed tripping from a direct acting mechanism, i.e., without relays.

Adjustable selective features will enable the operator or engineer to determine which of several breakers in series should trip first. It will also be possible to coordinate breakers with fuses and it will insure that the wrong breaker doesn't trip to shut down the whole plant for a short circuit on an insignificant branch circuit. It will solve the troubles of breaker application which we mentioned above, and some which we did not mention such as multiple circuits used as tie lines duplicate sources of supply, etc.

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RURAL LOAD

By A. E. KNOWLTON, Associate Editor, "ELECTRICAL WORLD"

Buying urge and spending power are both at such high levels in farming areas that those who serve them electrically are enthusiastic about the post-war prospects. Rural electric cooperatives, in particular, are confident that government will sustain the current earning capacity and spendable margins in the transition. Farmers have become eager for electrical aids in both the farm home and the farmstead as never before. There is therefore the basis for a large-scale resumption of line extensions to supply the thousands of devices that will be bought to do the chores in the house and out on the farm.

Prospects in Highlight

Seven out of ten cooperatives expect at least 10 percent growth in number of customers in two years and many feel far more encouraging. Nearly half the utilities feel they, too, will have a 10 percent increase.

From 88 to 95 percent of the cooperatives look for large-scale activity in refrigerators, ranges and water pumps; the corresponding response of the utilities runs from 74 to 92 percent.

Dairy and poultry equipment top the list of farmstead prospects but deep-freeze units and cold lockers fall only slightly behind with both utilities and cooperatives.

To expand the load-carrying capacity of the systems to meet the expected increases in load the cooperatives and utilities alike will put in larger transformers as the very first measure; second in sequence or importance will be the stringing of additional conductors and third the application of voltage regulators to hold the voltage up.

Reclosing oil circuit breakers hold first place in favor with cooperatives as a means of sectionalizing

to isolate troubles and keep outage areas and outage durations to a minimum. The utilities lean somewhat more toward multiple-shot fuses for this function.

More grounding and lowered-resistance grounding stand out as the dominant objective of both cooperatives and utilities in the field of line protection for surviving disturbances.

There is a nearly negligible interest in buried cable but a fairly healthy interest in some form of equipment which will automatically report when service to any significant area has permanently been interrupted.

Further standardization meets with favor all around but it carries little hope that it can be of large scope or be the means whereby rural line costs can substantially be lowered.

These assertions are founded on a detailed questioning of electric utilities and rural electric cooperatives. Responses tabulated and analyzed came from 82 of the cooperatives, each with over 1,000 customers, and from 27 utilities engaged in sizeable activity in rural areas. The cooperatives included represent a 10 percent sampling of the nation's aggregate and they operate in 27 states; the largest number of reports (13) came from Indiana and next was Ohio with 7. Tennessee, Minnesota and Mississippi filed 6 each, and Illinois 5. The following states afford 3 reports each: Alabama, Iowa, Kentucky, Michigan, Texas, Virginia and Wisconsin. Other reports came from Arizona, Arkansas, Colorado, Delaware, Georgia, Kansas, Louisiana, Missouri, New Hampshire, North Carolina, North Dakota, Pennsylvania, South Carolina and Vermont. The 27 utilities are spread over 16 states with a maximum of 5 in a single state.

CUSTOMER GROWTH

Rural cooperatives are far more confident of increase in number of rural customers than are the private utility companies when both groups peer into the years immediately following the war. Of 82 cooperatives reporting (each over 1,000 customers) there were 71 that confidently expect 10 percent increase and several added "and more" or "by far" while others indicated even up to a doubling in number within two years; only four expected less than a 10 percent expansion in services. Some were sure of significant expansion right now if the materials could be gotten.

2-Year Growth in Customers

	Less than 10%	10%	11–20%	21–50%	More than 50%
Cooperatives	4	71	1	4	2
Utilities	15	12	0	0	0

In contrast a majority of the utilities appear to feel that prospective additions in number of customers on rural lines will rather be under 10 percent than more. Also none of those reporting feel that their increases will definitely be in the higher brackets of which some of the cooperatives are quite confident.

One factor mentioned as enhancing the number of potential customers for the cooperatives is activity like that of the Re-allocation Corp. formed in Ohio by officials of Farm Security Administration. Large acreages of farm land are held for post-war splitting into separate self-sustaining farms for returning war veterans. Each of these will add to the potential users and require added service facilities.

There is occasional mention of approach to saturation and this may well account for the few cooperatives and some of the majority of utilities who cannot see as much as 10 percent.

FARM HOUSEHOLD USES

Refrigerators, ranges and water pumping top the list of equipments which are expected to provide the major contributions to increased kilowatt-hour input to the homesteads on the farms. To show how immediate the prospects are, one cooperative said "we could place 50 each of ranges, refrigerators and washing machines right now if we could get them." Water heaters, radios, and the lesser appliances follow in

relative importance even though the pent-up demand is indicated to be an assuring one.

As Units Foresee Relative Additions to Farm Household Utilization

	Percent of Cooperatives	Percent of Utilities
Refrigerators	95	92
Ranges	93	96
Water Pumping	88	74
Minor Appliances	81	63
Water Heaters	73	70
Radios	68	55

About the same scale of importance is attached to the respective items by both utilities and rural cooperatives.

In several of the cooperative responses definite estimates were given of the number of ranges expected to be attached in the two years immediately following cessation of hostilities. These figures run as follows (in percentages of customers served): 5, 8, 10 (four instances), 12½, 16½, 18.

Prospects for added refrigerators spread over a much wider range than for electric ranges. Percentages reported were as follows: 2, 5 (two instances), 19, 23, 29, 40, 50 and 55. These comments should undoubtedly be considered in conjunction with the prospective farmstead use of quick-freeze and deep-freeze items given in detail in an ensuing paragraph because that item rates high in the farmstead group of utilization.

Of the cooperatives, a moderate number listed the household water heater as a promising item but those that did so mentioned substantially smaller percentage additions in prospect than were cited for the range, refrigerator and water pump. These ran 0.5, 1, 2, 2.75, 3.7, 5 (two cases), 13.5 and 18.7 percent of present customers. Utilities, insofar as they ventured supplementary comment, indicated a "not likely" or "slow progress" mood regarding water heater expansion in rural area. Some of these comments came from relatively large utilities where competitive services are often available into suburban fringes that verge into rural.

Saturation of radios is admittedly high but from the expectations of the cooperatives it must be spotty in density because some fairly high percentages of prospective radio purchases are indicated by the cooperatives. These percentage values ran 2 (two cases), 2.5, 4.5, 18, 20, 22 and 50. Against these were mentions of 85 and 100 percent present saturation values. No indication was given as to how much the prospects were based on the growth of FM and television, how much on just a second radio and how much on a desire for a better set. The utilities, here again, appear much less confident of ability to add units in this category.

Since all other home appliances were lumped in one category and the wattages and hours of use vary so much, the percentage of customers that will add them is quite variable. It ranged from 2 percent through 2.5, 5, 36 (three mentions) and 80 percent to as high as 110 percent. The washing machine was singled out for independent mention.

Putting all together it is apparent, further, that the farm household appliances are in such healthy demand as not to require very aggressive promotion.

FARMSTEAD USES

Practically unanimous opinion of both the cooperatives and the utilities with rural systems is that dairy and poultry equipment and cold-preservation of food-stuffs will top the list of post-war electrical purchasing by farms and farm communities. Combined, there is an 80 percent group which is positive that there will be a substantially increased load per customer in these categories; only 11 percent are negative or dubious. Next in order come the motored-tools, welders, etc., for repairing and maintaining farm tools and the electrically-powered equipments for handling grain and fodder.

Typifying the psychological rather than the coldly statistical temper there is the comment from one cooperative that the period from 1945–1952 will witness the greatest spurt in development of new farm machines and equipments that has ever been experi-

Relative Promise of Coming Farmstead Uses

	Cooperatives		Utilities	
	Yes	No	Yes	No
Dairy Equipment	70	2	22	3
Poultry Equipment	69	2	23	3
Deep-freeze	67	1	23	1
Cold Lockers	50	3	17	6
Shop Tools	52	7	7	13
Grain Handling	40	7	3	16
Forage Handling	26	12	6	12
Soil Heating	11	18	9	13
Irrigation	9	20	14	4

enced. More specifically, another predicts that the processing and freezing of foods on the farm will reach undreamed-of proportions in the next decade.

Dairy and Poultry

Of the 109 units which supplied the information on which this study is based, exactly 92 in each case said that dairy and poultry equipment would be dominant in the electrical acquisitions by farmers. Only 10 expect little activity in these two fields and only 7 failed to enter these two items in the list checked.

Percentages of customers on various cooperatives that are expected to add electrified dairy equipment run as follows: 5, 5.5, 10, 12, 13.5 and 38. Utilities hazarded no estimates of volume but they were nearly as unanimous about confidence in dairy electrification as the cooperatives.

There has been a sizable increase in some areas in animal units under the U-1-C priorities aimed at increasing the supply of dairy products; there seems to be expectation that this expansion will not only hold firm but be further electrified.

Milkers, coolers and water heating are mentioned as specific items and there is also mention of germicidal lamps for livestock barns because the operating costs are low and the results are economically beneficial.

Brooders and incubators for poultry farms run in parallel popularity and promise with the dairy equipment for post-war activity. A like 84 percent put them in that position. The probable percentages of customers who would be the purchasers range as follows: 5, 11, 15, 18, 31, 36. Ultra-violet lighting in the brooders is considered a hopeful prospect because experience is reported to have shown some raisers that chick mortality can be cut from the 20-25 percent with cod liver oil applications to 8 percent with ultra-violet.

Farmstead Refrigeration

Interest in deep-freeze equipment and cold-lockers runs high and so do the expectations as to prospective loads by both the cooperatives and the utilities engaged in rural service. In fact, there is a slightly larger net tally for deep-freeze than for dairy or poultry equipment because a smaller number considered their particular prospects quite moderate. Also individual estimates of new commitments run toward more impressive percentages of customers: 1, 2, 7.3, 10, 12.5, 16, 18, 50. Some of these estimates are contingent upon the availability of the units in domestic sizes so that the farm household can at least conserve the farm's own produce for off-season use of surpluses.

On the cold-locker there is a bit less assurance of intensified activity but nevertheless it definitely takes fourth place as an item of farming interest in things electrical. Both utilities and cooperatives foresee lockers of the community type, some of the units already serving some and expecting more. Several of the cooperatives express prospects in terms of customer percentages as high as 18 but the rest of the estimates run between 10 and 16 percent; these presumably refer to single-farm walk-in units. Where the community type is indicated the number in sight is typically 1 per 1,000 or 1,500 customers.

Shop Tools

Cooperatives to a greater extent than the utilities see a post-war call for electrically-driven tools on the farm. The cooperatives tallied 7½ to 1 on the promising side whereas the utilities were twice as many negative or dubious as there were hopeful about sizable increments of connected load of this nature. Their attitude is more in the expressed direction of "perhaps," "amount to little," "slight," "negligible."

On the other hand the cooperatives, inferably more intent on having the farms conveniently and efficiently equipped than on the annual kilowatt-hour consumption, expect large fractions of their users to add power-equipment for keeping the farm tools in good shape. These estimates run from 1 to 35 percent with such intervening values as 10, 13.5, 27 and 31. Principally included are tool grinders and electrically driven saws and welders. Acknowledgement is made that the latter may cause some difficulties as to dips and flicker but those drawbacks seem to be viewed as philosophically as ever.

Crop Handling

Facilities for handling grain crops are going to be a sizable factor in rural loading and line expansion, according to the indications given by cooperatives. However, they do not loom as large nationally as the items which have preceded. Somewhat less than half the cooperatives feel hopeful and nearly 10 percent discount that form of loading as a significant post-war factor. That is a national-average statement and probably indicates that the activity will naturally concentrate in the grain-producing areas. There was interest manifested in some form of packaged unit suitable for handling grain and ear corn.

Definite percentages of customers who are expected to install grain-handling facilities ran on the following order: 1.6, 2, 7.3, 9.4, 18. These came entirely from cooperatives. Utilities are quite certain (5 to 1 ratio) that this type of loading will not amount to much in their particular territories. They are somewhat less tepid about forage handling but the cooperatives, usually outdistancing the utilities in enthusiasm, are definitely less positive on the favorable side regarding the prospective loads resulting from forage handling. Again, however, there were some that have fairly defi-

uite quantitative ideas as to these prospects and they ange from 1.6 to 9.4 percent of customers probably ecceptive.

Plant Nurture

Majority of both cooperatives and utilities is quite ubious about soil-heating becoming an appreciable actor for post-war rural loading. Such comments as some hot-frames," just "some," and "small degree" re substantiated by estimates that run between ½ nd 2 percent of customers likely to participate.

Irrigation falls in the same class as soil heating as far as the cooperatives go (20 to 9 on the dubious side) but the utilities are quite a bit more hopeful (14 to 4). Nevertheless such indications as there are point to a percentage of the number of customers likely to be interested in pumped-irrigation as being a small one on a nation-wide basis.

Among non-listed items that were mentioned in supplementary comments were these: water heater, washing machine, electric fence, stock tank-heater, hammer mills and feed grinder. Hay drying was mentioned as a promising activity.

ADEQUACY OF SYSTEM

To keep the rural systems abreast of and, what's more, ahead of the loads that are implied by the foregoing recital of heartening prospects, something must be projected, planned and executed. For the great and almost unanimous preponderance of both cooperatives and utilities this is first and foremost a matter of enlarging the sizes of the transformers. The inference is that transformer sizes have been geared plenty close to the loads originally in sight and that now, with farm-district purchasing-ability at flood level, the loads in sight will demand more generous transformering of the services as fast as they materialize. So unanimous is the feeling that larger transformers will be wanted that less than two percent feel that the move will not be necessary, one a cooperative and one a utility.

Measures to Assure System Adequacy

	Cooperatives		Utilities	
	Yes	No	Yes	No
Install larger transformers	64	1	21	1
Run additional wires	63	9	19	3
Add voltage regulators	45	8	23	2
Apply capacitors	22	13	20	3
Tap more sources	28	15	10	9
Adopt higher voltage	6	26	14	8
Shorten service drops	10	15	1	15

Stringing of additional conductors to convert single-phase branches to three-phase feeders stands second in prominence as a factor in upped adequacy. However, the tone was qualified by expressions like "some," "possibly," etc. to such a degree that the running of more conductors is not too close a second to the measure involving installation of larger transformers. In fact, the large emphasis on the transformer factor tends to indicate that the provision of additional conductors is more a matter of meeting polyphase motor loads and of balancing phase loads generally than of specific insufficiency of ampere-carrying capacity in the single-phase circuits. This is borne out by subsequent comment on the raising of circuit voltage.

Reliance on voltage regulators is one of the confident ways of keeping circuits adequate, in terms of delivered voltage, for the loads to which they are to be subjected. It stood at the very top in the urban-suburban survey (ELECTRICAL WORLD, June 24, 1944) and it stands fairly high here in the scale of rural adequacy measures. Utilities and cooperatives view the regulator with about equal emphasis and favor. Among the 10 who are negative out of 78 that expressed themselves, there were indications that some systems are already pretty well regulatored and that the tallies pertain more to progressive additions than to any large-scale simultaneous installation on present circuits. Even the favoring comments carry such limiting phrases as "perhaps," "possibly," "on long lines only," "as needed," "a few, many now." Some indication was given that the step-type is favored.

Application of capacitors takes fourth place in the rural pattern, and, like the regulator, not standing out as prominently as in the urban-suburban survey. This can be accepted as natural to an appreciable degree because, for the longer lines, the inherent line capacitance not only obviates the necessity for capacitors but leads to abnormally high voltages at light loads unless the capacitors are switched. Nevertheless, there is healthy interest in the capacitor, particularly on the part of utilities, perhaps because their lines range less far afield from the more numerous sources available on their systems. Both utilities and cooperatives embrace units that report "adequate

now" or "plenty already" and others that qualify their favorable opinion by stating "perhaps," "small extent," to "definite limits only" and "a few, as needed."

More sources are desired for their rural feeders by cooperatives in the ratio of nearly two to one against those who are content with what they have now. Utilities are about evenly divided as to whether they have enough sources at right locations or could benefit by having others to tap. Ties to more utility sources were the only measures mentioned as a way of getting additional supply as near as possible to the cooperative load.

A question was asked about gaining in system adequacy by shortening the service runs of secondary wire for the sake of keeping voltage drop to a minimum value. That measure, if it can be done, is another form of bringing high voltage as near to the user as possible. Evidently there is comparatively little interest in such a measure because the utilities are practically of one mind that it offers no opportunity whatever and the cooperatives are definitely not very hopeful that much can be done in that direction. Many rural lines already find the farm house and farm buildings near enough to the road to permit stopping the primaries at the highway line and (2) in other cases a few sections of primary tap-line permit placing the transformer fairly near the load. These situations apparently are numerous enough to support the feeling that little can be gained by trying to shorten service leads. Such rural secondary runs as there are can always be shortened by putting in individual transformers, if justifiable.

That voltages are already high enough on rural lines is the opinion of 4 out of each 5 cooperatives; on the contrary, it is the opinion of only 8 out of the 22 utilities. The rest of the utilities (1) expect to raise voltage to 4,600 volts, (2) will engage in a limited amount of raising to a higher voltage, (3) will do it later but probably not within 2 years or, (4), even less favorably inclined, will do only as a last step.

UNDERGROUND CIRCUITS

Not a single cooperative or utility expressed a thought of possible resort to buried cable for the rural primary circuits. Several of the cooperatives, however, did express an intention to use or consider buried cable for secondary services or runs.

Interest in Buried Cable

	Cooperatives		Utilities	
	Yes	No	Yes	No
For primaries	0	45	0	22
For secondaries	6	42	0	22

The query was raised because opinion is often expressed that some modification of so-called parkway or trench-laid cable will probably prove the readiest alternative to overhead circuits. It is evident from the responses that this possible movement is only in the "thinking" stage and that the economies and operating techniques need to be clarified before the direct burial of conductors can make much progress, except where requirements entirely preclude the retention or installation of overhead circuits. It is also evident that little of the present or prospective mileage of rural circuits is considered to fall in that category.

SERVICE CONTINUITY

Lowered-resistance grounding is easily the prime objective in connection with measures to assure service continuity to rural areas. While a few of the cooperatives feel that their present grounding is good and adequate, there are 8 times as many feel that more grounding and less resistance in grounds is something desirable to achieve for the sake of bettered service. Among the latter group are some that confine the need only to special situations but others that run as high as one good new ground for every 5 or 6 customers. Utilities feel somewhat less urgent about improved rural grounding but even among

them there are three that admit the need for everyone that is contented with efficacy of present grounding. The proviso is added that better grounding is not always as possible as it is desirable because of earth conditions.

Service Continuity Measures

	Cooperatives		Utilities	
	Yes	No	Yes	No
Improved grounding	49	6	17	6
Additional arresters	43	8	11	12
Expulsion tubes	13	13	6	14
More rugged construction	14	16	1	18
Shortened spans	10	19	2	17

Fairly close second to grounding is the prospective installation of additional lightning arresters. This is true only in statistical terms, however, because many who responded "yes" call attention to various influences that qualify their answers. One factor is the extensive use of self-protecting transformers; another is the fact that certain systems are already well protected by arresters. Where this latter is not the case the estimates run as high as an arrester for every 9 or 10 customers. There is further evidence that consideration of intensified lightning protection is limited essentially to locations where the lightning outages have been particularly numerous.

Comparatively minor emphasis is placed on expulsion tubes. Their promise is being studied, according to some reports and, in general, the interest is confined to special situations. One comment was that tubes would be given consideration "where space is limited, as at one or two river crossings."

Among the utilities the feeling is definitely that their line construction in rural districts is plenty rugged as now executed. Some of this is undoubtedly attributable to the retention for the rural lines of a good part, if not all, of the standards of construction employed in urban and suburban areas. Cooperatives are more evenly divided on the issue, something like one in 6 expressing the belief that justifiable continuity would be fostered by building stronger than at present to withstand the wind and ice loadings. As many, however, feel that their present REA designs are sufficiently rugged to withstand mechanical stresses.

Cooperatives line up two-to-one against the practicability of shortening spans for the sake of promoting service continuity; the attitude appears to be that the spans should be as long as is economically practicable for the sake of investment economy. The utilities are even more preponderantly of the same mind.

On the whole, there will be no basic change in the design of rural lines. The betterments will evidently come from accessory protective devices and as much better grounding as can be secured by multiplying or improving the grounds.

SECTIONALIZING FOR SERVICE RELIABILITY

For clearing troubles and restoring service the reclosing circuit breaker holds greatest interest as a tool for sectionalizing toward minimized interruptions. The cooperatives unanimously favor it in preference to other possibilities and the utilities do so, two to one. One of the utilities did, however, add that its use of reclosing oil circuit breakers is primarily confined to junctions at substations.

Restoration and Fault Clearance

	Cooperatives		Utilities	
	Yes	No	Yes	No
Reclosing breakers	74	0	16	7
Multiple shot fuses	26	14	22	3
Manual disconnects	14	14	9	9
Single-shot fuses	8	17	7	11
Air-break switches	11	16	9	9

Multiple-shot fuses stand next in favor and proportionately more so with the utilities than is the case with the cooperatives. From the utilities does come, however, a proviso that they will be used "if good ones are available." The inference is drawn that the preference for the reclosing circuit breaker is in part the result of insufficient confidence in the multiple fuse.

Single-shot fuses and air-break switches command relatively less attention than simple manual disconnects as a means of sectionalizing to localize trouble. The latter stand 50/50 with both utilities and cooperatives. One-shot fuses are favored by only half as many as frown upon them in both camps. On the air-break switch issue the utilities divide evenly but the cooperatives show a majority against them.

The conclusion has to be drawn that conventional rupture in oil continues to be a primary reliance for circuit clearing at sectionalization points. Confidence in alternative devices is scattered among several items the strongest of which—the multiple-shot fuse—com-

mands less than one-third as much confidence as the oil device among cooperatives; utilities, on the other hand, do show a stronger leaning toward them than for the reclosing breakers, probably because they have given the fuses the tryouts that are the basis for progressive development.

AUTOMATIC OUTAGE REPORTING

Whether means is wanted for receiving automatically an indication that there is an interruption of a portion of rural system is none too certain if the attitudes of both the cooperative group and utility group are considered together. However, there is no doubt that the cooperatives by themselves are interested in having such facilities so that they can know promptly whether the continuity of service in remote areas has been disrupted and thus act to make early restoration. Fifty-three of them express an interest which ranges all the way from "have it now" and "definitely" to "possibly" and "may add." Only 9 are skeptical or uncertain and their stand appears to be based on the feeling that favorable decision will have to await more promising devices.

In the intermediate bracket are cooperatives that say the devices will surely be developed for broad acceptability and applications but it may be a "long way off" and almost certainly "not within two years."

The rural-utility companies are only one-in-six hopeful about wanting means to learn of sections that have tripped out. There were 18 saying "no" on the issue and the probable reason is that stipulated by one, namely, that such information is already available in cases where attendants are on duty at stations from which the rural feeders emanate. This reflects the likelihood that, on the average, rural lines off utility distribution systems run into more compact and contiguous territories than in the case of cooperatives. In the latter case, many of the lines run into sparser territory where means of receiving word of outages are less at hand than for the majority of the utilities. Nevertheless, there were three utilities that said they could foresee either gradual adoption or limited use for outage-reporting means as a tool for prompt restoration.

The query was solely directed at ascertaining whether facilities are desired for learning when sizeable remote areas are deprived of service and not in any sense for learning about transitory and mere faulty conditions. The latter would manifestly require much more intricate and elaborate facilities, if really capable of practicable development at all at less than utterly prohibitive outlay.

STANDARDIZATION

Standardization of rural-line design and material is strongly favored as a way to simplify construction and keep costs down. A great preponderance of cooperatives (53 to 3) and a bare majority of utilities (13 to 10) were recorded in support of the assertion. Whether, however, further standardization can be achieved in enough additional magnitude to further reduce costs appreciably is a much less certain belief. Comments from both groups carried such remarks as the following: now 100 percent standardized; doubtful about being able to cut present costs but will further simplify wherever possible; slight prospects, but effort will be continued in that direction.

Conclusion can be drawn that standardization is more to be counted upon toward holding the status quo in rural line costs than as a medium for any startling reduction in normal costs.

Double Transmission Capacity By Use of Voltage Regulators

Voltage regulating transformers, fixed voltage boost, synchronous condenser operation of turbine-generators, high-speed circuit breaker reclosure, all effectively coordinated in supplying 64,000 kw. territorial demand

T. LOGAN, Operating Engineer, Georgia Power Co., Atlanta

INCREASING recently, for a certain Georgia area, the capital investment represented in lines and step-down substations by approximately 7½ per-ent in voltage regulating equipment more than doubled the capacity of the 110-kv. power supply to the area. As the 110-kv. transmission line emanating from Macon was extended to the extensive territory east and southeast of Macon, it was recognized that voltage control methods would largely determine the amount of power that could be supplied over this single-circuit line. Because of the great distances encountered it was decided the transmission line voltage should be allowed to vary over wide ranges and that substations connected to the line would be provided with low tension voltage regulating equipment where required, to compensate for transmission line voltage variations. The location of voltage regulating transformers, fixed voltage boost and maximum hourly demands are shown. Transmission line conductor sizes and lengths are listed in Table I.

Distribution Voltages

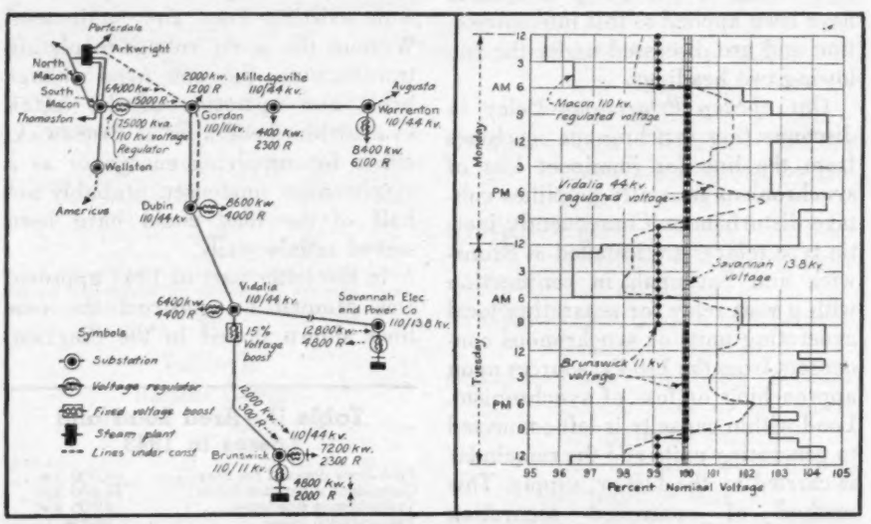
Voltage regulating equipment is not provided at the Gordon and Milledgeville substations since required operation of the 110-kv. voltage regulating transformer in the source end of the line at Macon inherently gives these two substations compensated voltage, i.e., higher on peak than during valley load periods. The 44-kv. automatic voltage regulating transformers located at Warrenton, Vidalia and Brunswick and the 110/44-kv. automatic tap-changing-under-load transformer bank at Dublin employ line-drop compensating features for giving the desired voltage at selected load centers. The effectiveness of this method of voltage control is shown by Fig. 1 which is a record of voltages supplied typical substation low tension busses.

At Savannah the 110/13.8-kv. tap-changing - under - load transformer bank is controlled manually in order to regulate the flow of reactive kva. between the generating station and the 110-kv. line. This transformer bank allows the 110 kv.-line voltage to swing over most of the allowable 20 percent range from peak to valley load periods while holding flat voltage on the 13.8-kv. bus at Savannah.

The 11-kv. voltage regulating transformer at Brunswick is also operated manually because satisfactory means for coordinating the automatic controls of the voltage regulating transformer and the voltage regulator on the 5,000-kva. turbine-generator, which normally operates as a synchronous condenser under vacuum cooling[1] has not been worked out and applied.

At Macon, the 110-kv. voltage regulating transformer is operated manually according to a preset hourly voltage schedule, the number of daily tap changes thus being held to a minimum.

Power flows along transmission lines only when the voltage at the receiving end lags the voltage at the



SCHEMATIC diagram (left) of 110-kv. transmission system. During 1943, 311 million kw.-hr. flowed over this 323-mile, tree-type line. Chart (right) of sending and receiving voltages as controlled by voltage regulators. Only at Brunswick is the full 20 percent range of the voltage regulators required and then, after the load reached 18,000 kw.

Table I—110-kv. Conductor Sizes and Lengths

Section	Conductor	Length, Mi.	Remarks
Macon-Gordon	4/0 Copper	19.1	Constructed for 66-kv. operation in 1926-1927
Gordon-Milledgeville	3/0 ACSR	14.6	
Gordon-Dublin, Single Wood-Pole Construction	1/0 Copper	34.9	Converted to 110-kv. operation in 1936-1937
Milledgeville-Warrenton	4/0 Type F. CW. Copper	40.3	Constructed in 1941
Dublin-Vidalia	2/0 Type F. CW. Copper	36.1	Constructed in 1941
Vidalia-Savannah	2/0 Type F. CW. Copper	79.2	Constructed in 1941
Vidalia-Brunswick	2/0 Composite*	99.2	Constructed in 1942

* 3 strands aluminum and 4 strands steel, No. 3 copper equivalent.

sending end, the degrees lag determining the amount of power that flows. This holds true until the steady state limit is reached after which further increase in angle will result in loss of synchronism or instability.

Fast Correction Necessary

Transmission line voltage phase angles between ends of the line, with a given line loading, very approximately inversely as the square of the voltage levels. Consequently, a heavily loaded line such as this one becomes unstable from voltage disturbances affecting it, even if of a relatively mild nature unless corrected within a few cycles. This line has become unstable on a few occasions, resulting in separating the Savannah and Brunswick plants from Macon due to voltage disturbances from short circuits reflected on to the Macon 110-kv. or Savannah 13.8-kv. buses from other connected lines that were not cleared within 15 cycles.

As 10 to 15 cycles clearing of faults on all lines that cause an appreciable drop in voltage on these buses is impossible under present conditions, means for minimizing the objectionable effects of out-of-step conditions have been applied to this interconnection and are discussed under the following two headings.

Out of-Step Protection—Delay in disconnecting synchronous machines from the line for imminent loss of synchronism generally amplifies voltage disturbances. Consequently inertia type relays[2] are installed at Brunswick and Savannah in conjunction with a watt relay for separating local generating units or synchronous condensers from the 110-kv. sources upon approaching or loss of synchronism. Load within capacity is left connected to generating units and the remainder is carried by the 110-kv. supply. This method of controlled separation greatly reduces the intensity of the voltage disturbance along the line and avoids an interruption to service. Isolated generating units or plants are re-synchronized with the 110-kv. supply at convenience.

High-Speed Circuit Reclosure—All 115-kv. circuit breakers installed in the line and taps are equipped for high-speed reclosure after trip-out.[3] The relay combinations described above separate generators at Brunswick and Savannah from the 110-kv. supply upon loss of power input to the station accompanied by a drop in frequency. Isolation of synchronous machines is detected instantly on the breaker controlling the line by means of three-phase undervoltage devices connected to the line side bushing capacitance taps. The breaker is blocked from closing as long as any phase shows as much as 50 percent voltage. The instant the line is dead the breaker recloses without delay.

Increase in Line Capacity

The kw. and kwh. losses in serving this area in 1943 were large, as shown in Table II. In normal times such losses would justify additional transmission line capacity but in 1942-1943 the line material situation was so critical that it was necessary to serve the load in some satisfactory manner with existing lines and equipment. Without the seven voltage-regulating transformers, the one fixed voltage boost and operation of the 5,000-kva. turbine-generator in Brunswick, either for supplying energy or as a synchronous condenser, probably not half of the load could have been served satisfactorily.

In the latter part of 1943 approval was granted to construct the new lines shown dotted in the diagram.

Table II—Area Load and Losses in 1943

Peak-hour demand for area	64,000 kw.
Coincident substation loads	54,300 kw.
Transmission line losses	9,700 kw.
Transmission losses	15.2%
Territorial consumption	276,933,200 kwh.
Transmission line losses	34,100,000 kwh.
Total input to territory	311,033,200 kwh.
Transmission losses	11.0%
I^2X losses	18,000 rkva.
Line charging current	16,000 rkva.

That work is well underway and when finished the service to this rapidly growing area will be with moderate kw. and kwh. losses.

The purpose of the article is to illustrate what can be done with a minimum of material when the materials are wisely used. The copper in the voltage regulators, if strung out in transmission lines would have served no useful purpose, but when used with a few tons of iron in voltage regulators, it made possible the serving of at least double the amount of load over existing lines.

References in this article are:

[1] Synchronous Condenser Operation of Turbine-Generator Under Vacuum Cooling: *Electric Light and Power*, August, 1943.

[2] Inertia Relay "Anticipates" to Facilitate Reclosure: ELECTRICAL WORLD, April 6, 1940.

[3] Line Relayed to Adjust Local Stations to Local Loads: ELECTRICAL WORLD, April 17, 1943.

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Fluorescent Sales The Utility Factor

That the lighting salesman of the electric utility has been a larger factor than any other—47.5 percent against a field in which the next highest is 25—in influencing installations of fluorescent lighting in commercial establishments is brought out in a preliminary report on a commercial lighting survey made under the direction of A. F. Loewe, Lamp Department, General Electric Company. The sample interviews from which the preliminary data were compiled were made in 30 cities and 11 states.

Of those asked from whom they would seek advice in the installation of more fluorescent lighting, 63 percent said they would consult the utility man. The next in the field was [illegible] percent.

The report further shows that 62 percent of those interviewed had lower meter readings after fluorescent lighting was installed than when they used incandescent. Higher readings were reported by 36.5 percent, showing that the idea of more and better lighting by fluorescent lamps is really taking hold. Also it is shown by the ratios of connected load to energy usage that fluorescent lamps are in use more hours per day than were incandescent by 69 percent of those interviewed.

Determining Cable Test Schedules

Analysis of costs of cable failures and of cable testing results in curves by which economical maintenance schedules may be determined—Method is equally applicable to other system components

C. F. AVILA and V. S. McFARLIN, Boston Edison Co.

ANY MATERIAL or apparatus is bject to troubles whose frequency d severity are known, and if they n be reduced a predictable amount periodic maintenance, it is posble to construct sets of curves from hich the most economical mainnance schedules may be determined. lthough the discussion which follows confined to cable testing, the same rinciples should be applicable to the spection and testing of relays, inlators or any other similar type of aintenance work.

To reduce cable service failures, eriodic tests are made with high oltage d. c. This study is a result of e determination, made over a peod of years, of the proper interval etween such tests.

In order to determine definitely the ptimum frequency for cable testing, e annual cost of trouble must be mpared with the annual savings ade by testing at various intervals. he results of this comparison are sed on curves derived from:

1. The extent of the repairs necessitated by service and test failures.
2. The labor and transportation costs to make repairs, determined with due regard to whether overtime work is necessary, plus the net material cost.
3. The value of the average outage associated with service failures in each of the transmission line groups.
4. The savings in dollars per test failure based on the above data plus miscellaneous savings.
5. A curve based on test experience giving the relationship between the number of tests per year and the percentage of total failures which are brought in on test.
6. For each transmission line group a number of curves, one for each of several assumed failure rates. Each curve is computed from the savings per test failure and the curve described in (5) above and shows the net savings at various test frequencies for the assumed failure rates.
7. A plot of the test frequencies showing greatest savings, as determined above, plotted against the various failure rates, gives for each line group, a curve which may be used to schedule tests when the failure rate is known.

Some of the more important figures used in this study are tabulated herewith, together with brief explanations of their application.

Table I

Total troubles and repairs required, 1937-1942 inclusive

	In Service	On Test
Number of failures	272	126
" " joints made	523	226
" " extension joints made	14	11
" " sections pulled	265	114
" " potheads replaced	6	8

The above totals exclude troubles which could not be intercepted by testing; for example, those due to lightning, fire, or mechanical injury by outside interference.

Table II

Repair Costs

	Regular Time	Overtime
Joint	$ 49.13	$ 68.38
Extension Joint	61.99	81.24
Section of cable (labor and truck only	64.00	104.00
Single-conductor potheads in sets of 3	101.83	121.08
Three-conductor potheads	127.07	146.32

These figures include all material except cable. When the cost of the latter is computed with due allowance for the amount salvaged and the cost of salvage, the repair cost of the average service failure is found to be $376. and of the average test failure, $408. The increased cost of $32 to repair a test failure is due to the fact that most test failures are repaired on overtime Sunday following break-down Saturday night when released for test. It is estimated that 40 percent of the service repairs and 25 percent of the test repairs are made on regular time and 60 percent of the service and 75 percent of the test repairs on overtime.

Table III

Line Group No.	No. of Service Failures	KVA-Hrs. Outage	Value of Outage	Value of Outage per Service Failure
1	20	6345.0	$1586.25	$79.31
2	62	4453.2	1113.30	17.96
3	90	13521.6	3380.40	37.57
4	76	0.0	0.0	0.0
5	24	169.0	42.25	1.76

This tabulation emphasizes the difference in outage experience in the various line groups.

For purposes of arranging for permitted outage, transmission lines are classified into groups according to the number of lines feeding a station or the loading or generating conditions encountered. Since these factors also have a bearing on the outage associated with trouble, separate tabulations are made for each group. The definitions of the line groups are as follows:

Group 1—Lines feeding stations or other loads supplied by only one line.

Group 2—Lines feeding stations which are supplied by two lines.

Group 3—Lines feeding stations which are supplied by more than two lines.

Group 4—Lines used as ties between generating stations.

Group 5—Lines supplying network transformers or customers having more than one line but requiring special permission for test.

A six-year total of outage due to service failures in each line group is shown in the following tabulation. To determine the value of this outage it is, of course, necessary to fix a fair

unit rate, all factors considered. For purposes of illustration in this study, a rate of $0.25 per KVA.-hour has been selected.

Average outage value in Table III is credited as a saving in the case of test failures: Other savings totalling $34.09 and applying to all line groups result from elimination, in the case of test failures, of damage to adjacent cables, necessity of inspecting station oil switches and of personal injury or property damage. Although failures of inter-station tie lines do not cause outage, loss results from the shift from economical to uneconomical generation caused by this type of line trouble.

An additional saving computed at $100 is therefore added for each test failure on group 4 lines.

From the total savings, the increased repair cost of $32 per test failure must be deducted, resulting in net savings per test failure as shown below:

Line Group Number				
1	2	3	4	5
$81.40	20.05	39.66	102.09	3.85

As the number of tests per year on a line increases, the percentage of test failures increases according to the characteristic shown in Fig. 1, Curve 1. This curve was originally plotted

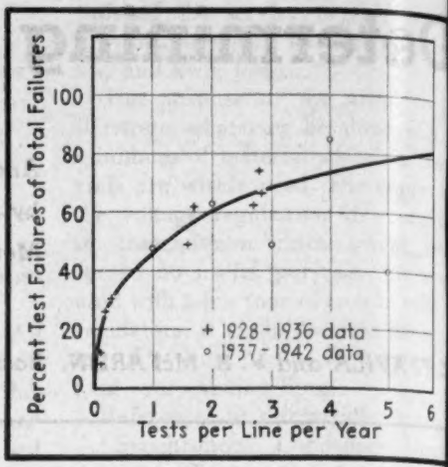
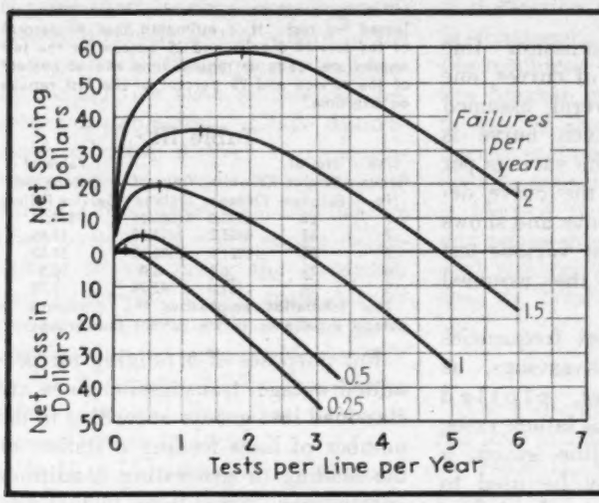


FIG. 1—Effect of testing—Average of all lines



...s and loss by testing Group 1 lines

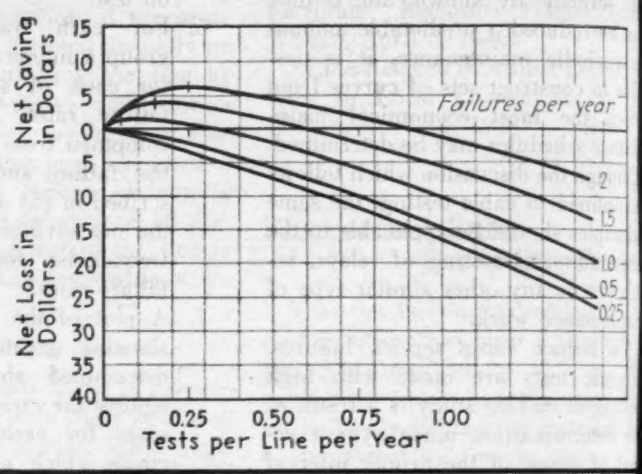


FIG. 3—Savings and loss by testing Group 2 lines

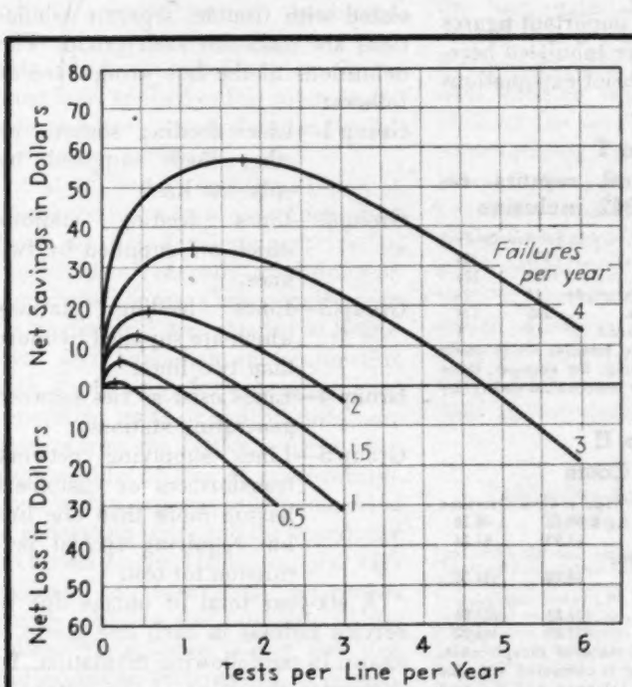


FIG. 4—Savings and loss by testing Group 3 lines

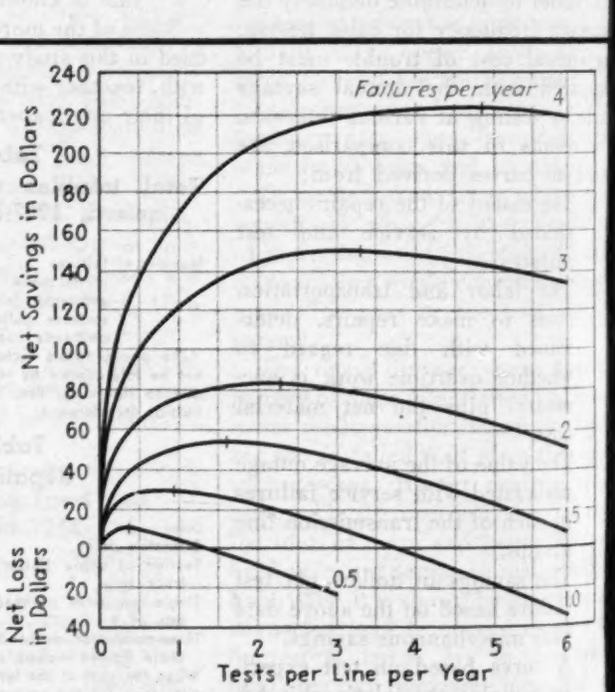


FIG. 5—Savings and loss by testing Group 4 lines

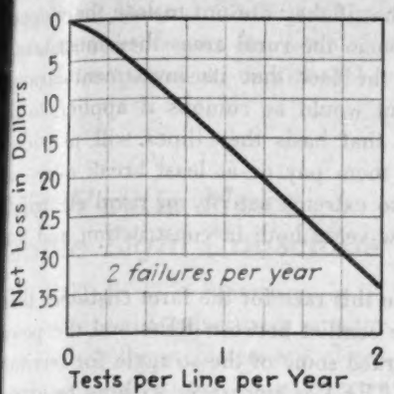


FIG. 6—Loss by testing Group 5 lines

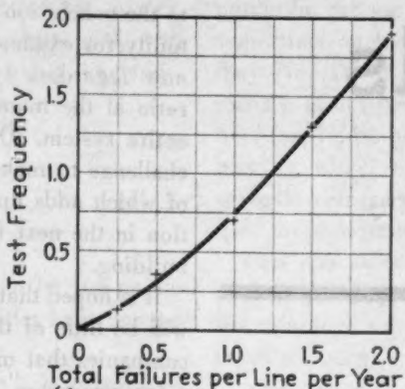


FIG. 7—Economic test frequency, Group 1 lines

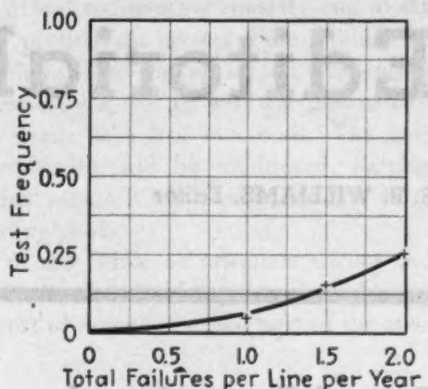


FIG. 8—Economic test frequency, Group 2 lines

rom failure and test totals applying o the whole system, and recent calulations based on lines frequently ested have not changed its trend.

Savings Shown on Curves

From Curve 1 and the net savings er test failure, families of curves are plotted. Each curve shows savings against test frequency. There is a curve for each of a number of assumed failure rates. Any point on a curve is obtained by multiplying together the assumed failure rate, the percentage test failures at the test frequency (Curve 1) and the net savings per test failure and subtracting from the product the cost of the testing at $19.50 per test. This procedure is repeated for each line group and the results are shown in Curves 2 through 6. The point of maximum saving is indicated on each curve.

Curves 7 through 10 show the most economical test frequency, obtained as above, plotted against trouble rate for Line Groups 1 through 4. The savings in the case of Group 5 lines are not great enough to justify testing at trouble rates now prevailing. In working with these curves, it has been the practice to use as the trouble rate the average troubles per year for the 4 years immediately preceding the test period. This interval is considered to be a reasonable compromise between one too short to give a representative rate and one unduly affected by conditions no longer existing.

Test Determinations

In preparing annual test schedules, when the trouble rate for any particular line gives a test frequency less than 0.25 per year, no test is made. When frequencies between 0.25 and 0.75 are indicated, the line is tested unless it was tested the previous year, in which case no test is made. Frequencies between 0.75 and 1.50 call for one test, between 1.50 and 2.50, 2 tests, etc.

To illustrate the use of the curves, examples are given below of one Group 3 and one Group 4 line having trouble rates sufficiently high to warrant that tests should be made.

Example 1—59-1383X line, Group 3

Number of Failures				
1939	1940	1941	1942	Failures/year
2	2	4	7	3.75

From Curve 9, a test frequency of 1.57 per year is indicated. On this basis, 59-1383X would be given 2 tests in 1943.

Example 2—12-2211 line, Group 4

Number of Failures				
1939	1940	1941	1942	Failures/year
2	2	5	2	2.75

From Curve 10, a test frequency of 3.2 per year is indicated. On this basis, 13-2211 would be given 3 tests in 1943.

Requirements Fix Schedules

It is thus apparent that as soon as a cable operating record is available for any year, the proper test frequency may be quickly determined for the following year.

Thus maintenance testing operations may be scheduled according to the requirements of service.

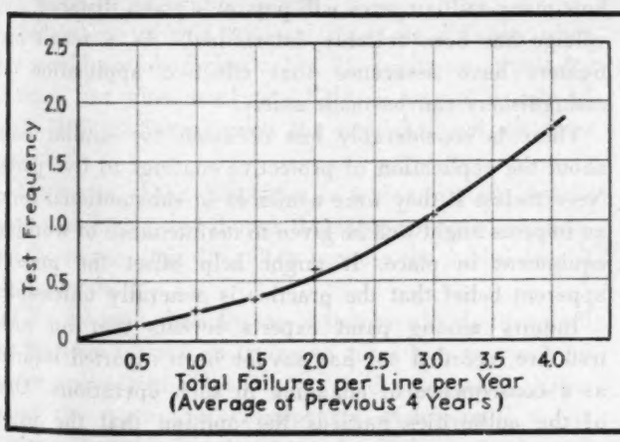


FIG. 9—Economic test frequency, Group 3 lines

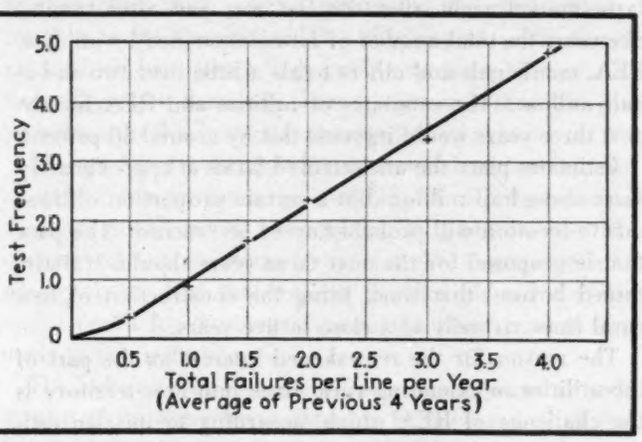


FIG. 10—Economic test frequency, Group 4 lines

Editorials

S. B. WILLIAMS, *Editor*

Record Expansion of Rural Lines in Post-War

NEXT SPRING when the frost comes out of the ground, and woodpoles are in better supply and there are no more orders limiting the use of electrical materials, indications are that we can expect to see the beginning of the greatest expansion in rural electrification this country has every experienced. The study in this issue of distribution for the post-war rural load relates largely to the extension of present lines but does not take into consideration the vast new rural areas which will be opened to service just as soon as materials and labor can be had for building new lines.

REA, for instance, has alloted from past appropriations nearly a hundred millions for lines that can go forward at short notice and has applications on hand for more than another hundred million. If Congress approves pending legislation REA expects to be able to spend in three years time around half a billion dollars, some of which, of course, will be for acquisitions but most of it for extending rural service. Its expenditures to date in connecting a little over a million customers of whom about nine hundred thousand are farm homes are under 400 millions.

The private power companies which at the end of the year served around a million, six hundred thousand farmers, in the next three years, according to a recent Edison Electric Institute study, plan to add 520,000, or approximately a third more, farm customers.

The electric utilities began to be really attracted to the farm market right after the last war and after twenty-five years the total number of farms electrified by utilities, REA, municipals and others totals a little over two-and-a-half million. The estimates of utilities and REA for the next three years would increase this by around 50 percent.

Estimates place the unelectrified farms at approximately three-and-a-half million, but a certain proportion of these due to location will probably never be reached: The pace that is proposed for the next three years should, if maintained beyond that time, bring the construction of new rural lines virtually to a close in five years.

The reason for the reawakened interest on the part of the utilities in extending rural lines into new territory is the challenge of REA which, according to its own estimates, has in the past five years outstripped the utilities in this activity three to one. The utilities have now come to the conclusion that if they are not to lose their opportunity for expansion in the rural areas they must take it now regardless of the fact that its investment-earning ratio at the moment would be ruinous if applied to the entire system. On that basis these lines will provide a challenge to make them pay or at least break even—all of which adds up to extreme activity in rural electrification in the next few years both in construction and load building.

It is hoped that in this race for the farm customer there will be little of the conflict between REA and the power companies that marked some of the struggle for territory a few years ago. If REA is sincere in wishing to extend service only where it cannot be secured from other sources it will not interfere with projects staked out by utilities provided, of course, they have taken the good with the bad in laying out these lines. Likewise, the companies should be equally sincere in not trying to prevent REA from entering an area that they have never wanted nor would now care to serve were it not for the fact that REA showed an interest. Furthermore, if there is an area which wants service and the nearest company does not feel justified in extending its lines it should do what it can to help that area get REA financing.

Just as the close of the last war opened up the rural electric market, so the close of the present war will be the signal for the spurt that will complete the extension of service. That, however, is but the beginning—the real work which will never stop will be the ever-expanding use of service on the farm proper.

Conductivity of Paint Spray

HOW DANGEROUS would it be to spray a paint on metal on energized objects for the purpose of protection against corrosion and deterioration? The question has been asked in all seriousness by an operator who wanted to know whether he could safely paint transformers in service with a spray gun.

That kind of information is now generally available about water streams, hose lines, and mist-nozzles. Just how many milliamperes will pass at a given distance and voltage has been reliably determined. As a result fire fighters have assurance that effective application of extinguishers can be made safely.

There is considerably less occasion for similar data about the application of protective coatings to live parts. Nevertheless if they were available in substantiated form an impetus might well be given to maintenance of working equipment in place. It might help offset the present apparent belief that the practice is generally unfeasible.

Inquiry among paint experts reveals that no such tests are recorded nor has anyone been reported injured as a consequence of engaging in such operations. One of the authorities hazards the opinion that the paint stream does have a conductivity far in excess of an

dinary air gap but nowhere near that of an unbroken id stream because of the multiplicity of air spaces. nly authoritative tests can establish the facts and, with oper encouragement, they would probably be made.

One Way to Make People Light Conscious

OW HOT IS IT? What time is it? To let the public now, enterprising advertisers in many cities have erected rge outdoor thermometers and clocks.

A reader has written us a letter, which is printed in nother section of this issue, suggesting that perhaps some-ing similar can be done with the foot-candle meter. hy not?

How much light do we get outdoors in bright sunshine at twilight? Perhaps if the public had a better notion these values by seeing actual measurements we would ve less difficulty in getting them to use higher foot-ndles values indoors.

People can become interested in light just as they are temperature or time. They can become interested in the ily fluctuations of sunlight. And as they become inter-ted in natural light they will become more conscious of e values of artificial light.

Power company office buildings, power plant substa-ons, billboards—all offer possible locations for such rge foot-candle meters. And once installed there is no mit to the ways in which keen promotional minds can uild up public interest.

Branch Circuit Minimum Size

MOVE IS UNDER WAY to abolish No. 14 wire for anch circuits from the National Electrical Code and make No. 12 the minimum permissible size. This sug-estion will get a favorable response from many who eplore the overfusing of No. 14 circuits as well as from thers who believe that increased copper sizes are neces-ary to get the best service out of appliances and to pro-ide room for expanding usage.

The authors of this proposal sense the difficulty when ey would permit fusing a No. 12 appliance circuit for 0 amps. but when used as a lighting circuit at only 15 mps. Will customers carry the two sizes and use them orrectly?

That is one of the difficulties in trying to make certain hings mandatory that though desirable are not minimums. nd the reason it is difficult is because the public doesn't ully understand.

If No. 12 is the best for the customer why don't we sell im the idea instead of trying to force him to use it by ode or ordinance? This industry had never really gotten ehind the promotion of adequate wiring until a few ears ago and then just as it was beginning to make real progress the war intervened. Let's continue selling the public on the use of more conductor capacity and at the same time on how properly to protect those circuits, be they No. 12 or what. The answer to the over-fusing menace is not necessarily a No. 12 wire for that can be over-fused just as easily as a No. 14 circuit. The only way in which over-fusing will be minimized, barring periodic reinspection regularly with some penalty, is to have an understanding public.

This education of the public on adequate wiring and proper circuit protection is something that should enlist the combined support of every interested part of the electrical industry.

The Father of the Electric Range

AT THE N.E.L.A. EXHIBIT in St. Louis in 1910 the first electric ranges were shown to the electrical industry. There were five of them—the complete stock of the manufacturer. That was the introduction of electric cooking to an industry that knew it wouldn't work. That was the start of a business that has since brought to all branches of the electrical industry in the sale of current, equipment and installations a volume of business in excess of a billion dollars. The man who risked his all in that exhibit a third of a century ago and who has since been honored as the father of the electric range was George Alexander Hughes who died last week.

Four years ago when Mr. Hughes received the McGraw Award for Manufacturers, it was estimated that something over two-and-a-half million domestic ranges were in service, consuming about 2.3 billion kilowatt-hours for electric cooking. This was more than the consumption of either the street-lighting load or that for electrified railroads.

But as the McGraw Award citation states, Mr. Hughes did more than promote electric cooking. So thoroughly did he believe in electric service that he did everything in his power to build public confidence in the power companies and "defend them against political misunderstanding."

Though the electric range has not had as large a volume of sales as some other appliances, it has had a marked effect upon general residential use of electricity, for it was the springboard for the rise of promotional rates which have given such great impetus to the promotion of greater domestic consumption and thus the improvement in the American standard of living.

Though Mr. Hughes personally was not responsible for all these developments it can truthfully be said that electric cooking would never have made the progress in this country that it did were it not for his confidence and perseverance. For that reason to him should go the major credit for the contributions the electric range has made to this industry.

The industry has lost one of its great pioneers as well as one of its staunchest advocates in the passing of the father of the electric range.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

OWU's X-Day Program

X-DAY, the unknown but fascinating date of the final capitulation of Germany, will see the end, for all practical purposes, of order U-1, under which (with its predecessor P-46) utilities have been operating for three years.

At that time the wraps will be off everything but a few critical items such as meters, small transformers, wood poles and cross arms. Just how the control which will be necessary on these items will be effected has not yet been decided, but it could well be done by requiring approval of purchase orders for transformers and forbidding the purchase of poles or meters for new lines until the lines are ready for construction.

The restrictions on meters and transformers, further, probably will be retained only for a short time after the fall of Germany, for the conflicting military programs which have forced output of these items into the background will be chopped with the German defeat. Then, under WPB's reconversion program, manufacturers will be free to produce what they please, limited only by the military programs necessary for the defeat of Japan, or by critical materials. No materials required for production of meters or small transformers are expected to be short after X-Day.

Utilities to get Protection

The forthcoming end of U-1 is based upon the idea that with the wraps off everything else in the way of civilian production—again barring the few materials which will be short after X-Day, lumber, textiles and a few others—there is no reason for holding down utilities.

But this does not mean that utilities will be forced to compete with every conceivable type of non-war industrial activity for insufficient supplies of material which they urgently need. Provision will be made whereby utility projects will not be held up because of the inability to obtain some "nickel and dime" item. Utilities will, for instance, be assigned an AAA priority rating with which to obtain anything necessary to repair a breakdown or to avert a threatened breakdown in essential service. Whether this will be included in an extremely short version of U-1 which will also incorporate the transformer, meter and pole restrictions, or whether it would be done otherwise is academic. The important point is that after X-Day, utilities will have whatever protection is necessary, but will no longer face the restrictions they have known in the present and earlier versions of U-1 and P-46.

It is conceivable that in the reconversion rush, certain items may temporarily become as scarce as many became during the earlier stages of the war and defense programs. When such situations begin to affect utilities seriously, order boards can be frozen under the power behind the existing scheduling order, M-293, and deliveries directed to most essential users.

Pressing Needs

It is not anticipated that many such situations will arise, and the power to deal with them will not, under present thinking, be invoked until the need is real and pressing. The whole program is based on the principle that WPB's function in reconversion is to clear away all possible obstacles which might hinder the nation's industry in getting back to peacetime work. Thus, in administering its part of the program, OWU will be chary about imposing anew any obstacles once the path has been cleared. But the importance of such industries as utilities, transportation, petroleum and coal is known and recognized, not only by WPB but by the military services as well, and since these are basic, they will not suffer at the hands of less basic industries.

The outlook, then, is for a truly skeletonized Office of War Utilities not too long after X-Day. Its various divisions will still exist, and each will have a small but skilled staff of "bottleneck busters" whose job it will be to see that no utility projects are held up because of obstacles which can be eliminated. The project analysts, researchers and clerks will be gone, and there will be left only the few experts needed to do "trouble shooting" on such holdups as may occur. This at least, is the thinking now, even though the plan is colored by the difficulty of reducing almost to nothingness a large federal organization. OWU has dropped about 10 employes in the last several months, standing now at somewhat more than 350 employes.

Might Keep L-94

One of the decisions facing OWU is whether to maintain order L-94, under which certain interconnections were ordered. OWU would like to junk L-94 along with U-1 and its supplementary orders. But there are certain mandatory interconnections under the order which should be maintained for some time to keep the power supply picture in its present healthy state, and the question arises as to how happy some systems would be to remain interconnected on a voluntary basis. Some systems, notably municipals, have objected to interconnection and might refuse to maintain them unless compelled to do so.

The post-X-Day period will see increased reliance upon the industry advisory committees which have worked with OWU throughout the war, with several such meetings already scheduled. Manufacturers and purchasers of electrical equipment will be asked to police themselves during the period when there is insufficiency of production for needs. They will be warned of the strong feeling in Congress against monopolization by large concerns of all materials and components, to the exclusion of smaller competitors, and will be asked, during the period of stringency, to keep their ordering within limits which will allow all to get their minimum needs.

It is obvious that if small business and cooperatives, which are the darlings of Congress these days, are at all seriously discriminated against in purchasing, OWU will be forced to beat Congress to the punch by restoring such controls as are necessary to insure fair distribution.

NEWS OF THE WEEK

Leland Olds Confirmed by Senate for FPC Post

Administration Supporters Beat Down Allegations of Radicalism and Favoritism to Approve Second Five-Year Term—Sen. Moore Denounces Nominee as Unfit for Position Because of Communistic Background

Leland Olds regained membership on the Federal Power Commission this week when a bare quorum by a voice vote confirmed his nomination to a second five-year term.

The vote came after three hours of debate which saw administration supporters beat down allegations of radicalism and of favoritism in granting a certificate of necessity for a natural gas pipe line. Senator E. H. Moore, Oklahoma Republican, made the only protest against Olds, while Senators James M. Tunnell, Delaware Democrat, Lister Hill, Alabama Democrat and administration whip, George D. Aiken, Vermont Republican, and others ridiculed Moore's allegations, and praised Olds as "able, honest, efficient, dilligent" and as being worthy of confirmation "because of the enemies he has made."

Moore and Tunnell played similar roles—to almost identically the same music—last July when a subcommittee of the Interstate Commerce Committee held three days of hearings on his nomination. The subcommittee approved the nomination by a 3-2 vote.

Moore, who has held up consideration of the nomination since the full Interstate Commerce Committee reported it favorably last month so that a quorum might be present, opened the debate with a 34-page statement which contained little not brought out in the July hearings. He charged that Olds' background, principally as a writer for the Federated Press, was so intertwined with the activities of known communists that he rendered himself unfit for membership on the commission. He then clung to the circumstances under which the Tennessee Gas & Transmission Co. a year ago was awarded a certificate to construct a natural gas pipeline from the Gulf Region to the Appalachian area, while its competitor, The Hope Natural Gas Co. a Standard Oil affiliate, was not granted a hearing.

Moore, who came to the Senate after having made a fortune as an independent oil operator in Oklahoma, has been widely credited throughout the Olds controversy with having sought Olds' scalp because FPC failed to give the pipe line to the Standard Oil Co. affiliate, although no direct connection between his erstwhile oil activities and the Standard company has been shown.

"In 1939," Moore declared, "Mr. Olds came to FPC fresh from the background of long associations with Communistic thought and idealism; he came with the zeal and fire of a crusader; he came with the same inspiration and determination that characterizes the zealots of Radicalism and which has so premeated the New Deal administration that it has been the subject of condemnation of members of Congress from both the major political parties."

In virtually his only reference to issues of basic interest to the electric power industry, Moore pointed out that the fact that the Supreme Court has upheld the commission in the two cases most resented by state commissions and the industry, the New Jersey Central case and the Hartford case, "does not necessarily prove the soundness of the commission's action." He argued that courts "will not disturb findings of fact of an administrative body if there is any evidence to support the finding, however thin the evidence may be." Thus, he said, it is important that persons holding such administrative office "have a high regard for Constitutional government, a keen sense of fairness, justice and equity, and abiding faith in American traditions, be possessed of sound judgment and adequate powers of reason."

Charging that the Tennessee Gas & Transmission Co. received its certificate either "as a result of personal influence or as a desire of those who dominated the commission to favor public-financed projects to the exclusion of privately-financed enterprises," Moore asserted, "The failure of the commission . . . and Mr. Olds . . . to see that the Hope company was given a fair and impartial hearing was a rank and inexcusable abuse of administrative discretion."

Cites Harmonious Relations

In attacking Moore's statement, Senator Tunnell cited numerous letters from members or officials of many state commissions purporting to show only the most harmonious relationships between state and federal regulatory agencies. Included were letters from Oklahoma, Arkansas, New Mexico, Minnesota, Pennsylvania and California commissions, as well as from other public officials dealing with the commission. He argued that despite charges, the commission has never been defeated finally in the courts.

Senator Aiken protested against the references to Communism, and characterized Olds as "an efficient and honest public servant," who is "never afraid to fight his enemies." He said the Senate would be doing Olds a "great injustice to refuse him confirmation."

Senator James Mead, New York Democrat and a down-the-line administration man, told the Senate that Olds, from New York State, had the approval of both New York senators when he was first appointed and retains it today. He said Olds had been under legislative scrutiny before the Senate five years ago, also before New York Legislature while a member of the Power Authority, and his work was found to be of the best.

SUGGESTION JUDGES.—Members of New England Power System committee to pass upon suggestions for improvements in equipment and methods, a group activity which has been maintained for about 17 years. Front row, l. to r., Carl N. Thomas, secretary, and chairman of the system distribution standards committee; Herbert W. Greenhalgh, chairman suggestion committee; and John P. McCann, safety manager. Back row, l. to r., Philip C. Pray, New England Power Co.; Thomas A. Dowd and Lloyd Durfee, Narragansett Electric Co., Providence; Guy F. Woodward, Worcester County Electric Co.; and Harry J. Walton, Malden Electric Co.

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Under Langer's bill, a Missouri Valley Power Administration would be organized, headed by a $10,000 a year administrator, who would get all the energy not required to operate the project. He would be directed to dispose of it "by sale to consumers, either directly or through cooperative associations, at the lowest possible rates consistent with sound business principles, the rate schedules to become effective upon . . . approval by the Federal Power Commisison." He would be required to give preference to "consumers in rural areas who are not receiving central station service," and would be empowered to construct and acquire transmission lines and other facilities necessary to serve such consumers "in as wide an area as can be efficiently served."

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"The Administrator shall provide for the furnishing and installation of equipment and appliances to, and the wiring of the premises of, such consumers, at cost upon such terms as may be necessary to provide all such consumers a reasonable opportunity to purchase and utilize such electric power."

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president in charge of the merchandise department and in 1930 manager of the merchandise department in charge of engineering, manufacture and sales. In December of that year he was elected a vice-president, and by 1935 Mr. Wilson was directing all appliance activities of the company. In 1939, he was elected president.

•

Halt Work on REA Lines

Work has halted on construction of two power lines by the Rural Electrification Administration near Lebanon, Ore., upon action of the Mountain States Power Co. to enjoin the REA from continuing the projects.

The War Production Board issued stop work orders for both the power company and the REA on line extensions, each about 35 miles in length. Both interests originally surveyed the area for the construction work, and the REA recently was given the go-ahead signal by the WPB.

•

Buys TVA Peak Power

Tennessee Valley Authority has announced that a contract has been made with Louisville Gas & Electric Co., whereby the latter will receive 25,000 kw. of peak power for the six months period, August through January, delivery to be made over a high tension line between Louisville and Nashville, Tenn. missing links of which were built by TVA and L.G.&E., in 1942. The latter had a line from Louisville to Fort Knox and beyond, which was extended.

Arkansas Power Wishes to Extend Rural Lines

The Arkansas Power and Light Co. has filed petitions with the Arkansas Utilities Commission announcing its purpose to "resume its construction program" for service to rural areas. The company said it had abandoned the program because of wartime restrictions, now somewhat relaxed.

The company asked to be allotted territory in an area north and east of Conway in Faulkner county and an area around El Dorado in Union county and for permission to build extensions. Before the war the company had built several "thousand miles" of rural lines serving 16,000 customers, it was said.

The company proposes 11 extensions totaling 84 miles in the Conway area at a cost of $66,293. A. P. and L. estimated annual revenue available from the extensions at $14,987 and said 364 customers already had contracted for service.

Fourteen extensions totaling 107 miles are planned in Union county at a cost of $80,177. Estimated annual revenue is $18,316 and 390 customers have signed contracts. The commission will hear the applications October 3.

•

Co-op Buys Alabama Co.

Transfer of electric properties of the Alabama Water Service Co. to the Alabama Electric Cooperative was effected September 1, following approval of the transfer by the Alabama Public Service Commission. Mr. M. A. McWilli... Prattville, president of A.E.C., said ... cooperative paid a base purchase p... of $2,075,000 for the properties wh... include 298 miles of transmission ... distribution lines, three hydro-gene... ing plants and three Diesel generat... plants.

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Added Magnesium Cutba... Will Mean Fuel Savin...

Additional cutback of magnesi... production at two Texas plants ... at another in Nevada will result in ... tain unstipulated fuel savings in e... area, WPB disclosed last week.

The overall reduction of 40 perc... in primary magnesium ingot product... from 23,000,000 pounds monthly to ... 000,000 pounds will be effected at g... ernment-owned plants at Austin, Te... where the electric load is served by t... Lower Colorado River Authority, ... Velasco, Tex., served by a steam g... erating station connected with the m... nesium plant, and at Las Vegas, N... served principally by Boulder D... energy. Fuel savings will be had ... Velasco and by displacement at L... Vegas.

The Las Vegas and Austin plants w... be shut down over a period of monti... and the Velasco plant will be reduc... in output from 6,000,000 pounds ... 3,000,000 pounds monthly.

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Union Loses Wage Case

A union request for time and o... half pay after 40 hours weekly was d... nied last week by the regional W... Labor Board at Atlanta in a case ... volving the South Carolina Power C... of Charleston, and the Amalgamat... Association of Street, Electric Railw... and Motor Coach Employees of Amer... ca, (AFL).

The board ruled that the case cou... be re-opened by either party within ... days after establishment, by the n... tional board, of a national policy ... overtime payments in the transit i... dustry.

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Dnieprostroi Dam Planned

Dnieprostroi Dam, the world's large... when it was opened in 1932, is to b... rebuilt as soon as possible. The Rus... sians destroyed the dam and equip... ment to prevent their capture by t... Germans. A group of Russian hydr... electric engineers is now in the Unite... States purchasing equipment an... studying American hydroelectric pro... ects.

PRIZE WINDOW DISPLAY—Third prize in a recent national contest for window displays supporting the Fifth War Bond Drive was the above, displayed at Fond du Lac district offices, Wisconsin Power & Light Co. The prize, $200 in war bonds was awarded to M. R. Norton, district sales supervisor. Entry was in the division of the contest, sponsored by "Display World" and National Association of Display Industries, for entries from cities of less than 100,000 population

TELECAST COOKING DEMONSTRATIONS—Television recently lifted the cooking demonstration out of the auditorium and set it down firmly in the home when Chicago's television station WBKB in cooperation with Commonwealth Edison Co., launched a weekly series of telecasts featuring electric cooking. Members of the cast, above, are all employees of the utility. They are (left to right) Lillian Curtis, A.B. Rodner, Jr., and Merle Lucas

TVA Kentucky Dam Goes into Commercial Operation

First of the five 32,000-kw. generators planned for the Kentucky Dam at Gilbertsville, Ky., went into commercial operation on September 11. The dam is controlled by the Tennessee Valley Authority. The second generator is to go into operation this year, and the others will follow in 1945 or later.

Production of power will be restricted until November when the railroad tracks of the Illinois Central System which cross the Tennessee River on a bridge below will be moved to the top of the dam. Water level of the reservoir is expected to reach normal in December.

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Boiler Trouble Threatens Jacksonville, Fla., Power

If further mechanical difficulties arise at the municipally-owned Jacksonville, Fla., power plant, it may be necessary to ration power, Utilities Commissioner George A. Pearce has revealed in an appeal to citizens to conserve electricity.

Attributing the power shortage to boiler trouble despite a recent installation, Mr. Pearce explained that of the five boilers at the station, one is out of operation and another is operating at only half capacity. He added that the War Production Board gave the city priority to purchase but one boiler when two had been requested. The emergency, he said, is likely to continue until December.

Jacksonville has a 10,000-kw. tie-in with the Florida Power & Light Co. which was installed early in the war on government order.

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West Palm Beach Votes Approval of Utility Tax

A tax on utility bills to finance a seven-year post-war public works improvement program has been approved by the voters of West Palm Beach, Fla., 1,460 to 846. About seven years ago a similar tax was voted down.

The program, calling for an expenditure of $1,688,000, includes such projects as the improvement or construction of docks, sewerage system, incinerators, sidewalks, streets, seawalls, and elimination of pollution in Lake Worth which separates West Palm Beach from Palm Beach. The city has $200,000 in its post-war fund, and the utility tax is expected to bring in $175,000 a year.

Tax rates on all utility bills will be 10 percent on the first $25; 5 percent on the next $50; and 1 percent on the remainder.

Rate Case Litigants Act to Protect Public

James W. Williams, assistant attorney general of Michigan, has announced that the Ingham County circuit court, the Detroit Edison Co., and the Michigan Public Service Commission are working out details of a surety arrangement to protect the public interest in a $10,450,000 fund the company has been ordered to rebate to customers in southeastern Michigan.

The agreement results from a complaint by the City of Detroit that Detroit Edison secured a faulty court injunction suspending enforcement of the rebate order issued by the Public Service Commission.

In a conference with Plummer Snyder, counsel for Detroit Edison, and Circuit Judge Charles H. Hayden, Mr. Williams said, a surety plan was agreed to, but details have not been settled.

He said the company would set up the affected money separately on its books and either would separate it from other funds or place it within a designated depository.

"Since the company has not been commanded by the commission to do anything before September 15," Mr. Williams said, "there is no delay in arranging this matter."

Originally, the company appealed from the commission order to it to rebate the $10,450,000 to avoid payment of federal excess profits taxes.

Mr. Williams indicated the bond plan was a shortcut to avoid extended controversy over a protest by the City of Detroit that the court order holding the rebate was faulty.

Paul H. Krause, Detroit corporation counsel, told the commission that the restraining order issued by Judge Hayden was illegal because it was granted without a statutory public hearing. He urged the commission to lift the court order and place its rebate order in effect at once.

•

Arkansas Will Pay $793 to 2 FPC Staff Members

Arkansas Department of Public Utilities has agreed to pay a bill for $793 from the Federal Power Commission for services of two FPC staff members during the Arkansas Power & Light Co.'s rate base hearing before DPU. The FPC employees are Charles W. Smith, whose "original cost" concept was virtually termed "Socialistic" by the DPU, and William F. Spurrier, accountant, who represented FPC several days at the Arkansas hearing.

Calgary Firm Tries Rural Electric Test

In its Olds district, 60 miles north of Calgary, Canada, the Calgary Power Co. is ready to begin an experiment in rural electrification which will be self-liquidating and which will have no government aid in loans or grants.

A group of 100 farms has been selected in the district which company officials say is a typical rural community providing conditions and problems typical of any rural area served by the company.

The plan will require the construction of 75 miles of line, an average of about three-quarters of a mile per farm to be served. The total cost is estimated at $60,000 or $600 per customer.

Each farmer is to pay $100 for the installation of the line to his home. The farmers will therefore pay $10,000 or one-sixth of the original cost. The company will pay the remainder.

Minimum charge will be $5 monthly for a minimum of 20 kw.-hr. and 2 cents for each kw.-hr. over 20. In this way, the minimum monthly rate will return the company $6,000 a year or 10 percent on the original investment out of which amortization costs must be met.

•

Senate Votes More Funds for Reclamation Hearings

The Senate last week voted an additional $5,000 for the sub-committee headed by Sen. Ernest W. McFarland, Arizona Democrat, which has been conducting hearings on dual-purpose reclamation projects in California and Arizona. It was understood that the additional funds are to finance further hearings, one of which may be held in New Mexico.

Two hearings already have been held, one concerning irrigation projects in California's Central Valley, the other at Phoenix, Ariz., on the possibility of diverting water to central Arizona.

•

Narragansett Electric Co. Will Cut Plant Accounts

Proposals of the Narragansett Electric Co., Providence, R. I., to eliminate from its electric plant accounts amounts totaling $10,593,052.49 representing the unamortized balance of excess of acquisition cost over original cost of acquired properties, have been approved by the Federal Power Commission.

The disposition is to be effected by amortization over a 15-year period beginning July 1, 1944. The company's previous elimination of $4,702,402.08 brings to a total of $15,295,454.57 the adjustments made in the company's plant accounts.

Original cost of the company's electric plant as of January 1, 1937, the effective date of the Commission's uniform system of accounts, was $47,813,584.17. Thus the adjustments represent about 32 percent over the original cost.

•

Connecticut L. & P. Offers $10,000,000 Bond Issue

Connecticut Light & Power Co. through a banking group headed by Putnam & Co., Hartford, and Charles W. Scranton & Co., New Haven, has offered for sale $10,000,000 of first and refunding mortgage 3 percent bonds Series I. Dated September 1 and due in 1974, the bonds are now priced at 105¾ to yield approximately 2.72 percent to maturity.

The company will use the proceeds to retire $7,000,000 of first and refunding mortgage 3½ percent bonds, Series F due Sept. 1, 1966, called for redemption on Sept. 1, 1945 at 106, and to replace company funds used in the purchase for cancellation of $3,366,000 of first and refunding mortgage 7 percent, Series A, bonds, due May 1, 1951.

•

Canadian Facilities Grow

Canada will emerge from the war with electric power production facilities over 21 percent in excess of 1939, Department of Munitions officials have announced. To the 8,190,000-hp. capacity of 1939, 1,803,000 hp. has been added to make a total of 9,993,000 hp.

MEETINGS

Pennsylvania Electric Association—Systems Operation Committee, Roosevelt Hotel, Pittsburgh, Pa., October 26-27. A. R. Deck, chairman, Metropolitan Edison Co., Reading, Pa.

American Society of Mechanical Engineers—Annual meeting, Hotel Pennsylvania, New York, N. Y., November 27-30. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Previously Listed

International Association of Electrical Inspectors—Eastern section, DeWitt-Clinton Hotel, Albany, N. Y., September 18-20; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern section, Ainsley Hotel, Atlanta, Ga., September 25-27; A. M. Miller, secretary, 219 Governor St., Richmond 19, Va.

Indiana Electric Association—Annual fall meeting, French Lick Springs Hotel, French Lick, Ind., September 20-22. E. F. Hauser, secretary-treasurer, 1414 Circle Tower, Indianapolis, Ind.

International Association of Electrical Leagues—Annual conference, Book-Cadillac Hotel, Detroit, Mich., September 20-22. O. C. Small, secretary, 155 E. 44th St., New York 17, N. Y.

Indoor Climate Institute — Open forum on conservation and post-war planning, Book-Cadillac Hotel, Detroit, Mich., September 21-22. R. E. Moore, secretary, Penobscot Bldg., Detroit 26, Mich.

Southeastern Electric Exchange—Engineering and operation section, Roosevelt Hotel, New Orleans, La., September 21-22; sales conference, Henry Grady Hotel, Atlanta, Ga., November 9-10. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 3, Ga.

Maryland Utilities Association—Mid-year meeting, Lord Baltimore Hotel, Baltimore, Md., September 22. R. C. Brehaut, secretary, 1100 H St., N. W., Washington 1, D. C.

Association of Iron and Steel Engineers—Annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., September 25-27. Brent Wiley, managing director, Empire Bldg., Pittsburgh 22, Pa.

Municipal Electric Utilities Association of New York State — Annual meeting, DeWitt-Clinton Hotel, Albany, N. Y., September 26-27. T. J. McKee, secretary, 200 E. Third St., Jamestown, N. Y.

National Electrical Contractors Association—Annual meeting, French Lick Springs Hotel, French Lick, Ind., October 1-5. L. W. Davis, general manager, 633 Investment Bldg., 15th and K Sts., N.W., Washington, D. C.

Edison Electric Institute—Prime movers committee, Wm. Penn Hotel, Pittsburgh, Pa., October 2-3; electrical equipment committee, Schenley Hotel, Pittsburgh, Pa., October 5-6; transmission and distribution committee, Hotel Statler, Buffalo, N. Y., October 9-10. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

International Municipal Signal Association — Annual meeting, Hotel Statler, Boston, Mass., October 2-5. Irvin Shulsinger, secretary, 8 E. 41st St., New York 17, N. Y.

National Safety Council—Annual congress, Sherman, Morrison and LaSalle Hotels, Chicago, Ill., October 3-5. N. H. Dearborn, managing director, 20 N. Wacker Drive, Chicago, Ill.

National Electronics Conference—Medinah Club of Chicago, 505 N. Michigan Ave., Chicago, Ill., October 5-7. Beverly Dudley, secretary, 520 N. Michigan Ave., Chicago 11, Ill.

Kansas Association of Municipal Utilities—Annual convention, Broadview Hotel, Emporia, Kansas, October 8-10. Grace L. Crosman, asst. secretary, McPherson, Kansas.

Electrochemical Society—Fall meeting, Hotel Statler, Buffalo, N. Y., October 12-14. Colin G. Fink, secretary, Columbia University, 3200 Broadway, New York, N. Y.

American Welding Society—Annual meeting, Hotel Cleveland, Cleveland, Ohio, October 16-19. Miss M. M. Kelly, secretary, 29 West 39th St., New York 18, N. Y.

Pennsylvania Electric Association—Electrical equipment committee, Johnstown, Pa., October 19-20. A. N. Shealy, chairman, Pennsylvania Water & Power Co., Lexington Bldg., Baltimore, Md.

Electronic Parts and Equipment Industry Conference—Hotel Stevens, Chicago, Ill., October 19-21. Chas. Golenpaul, publicity chairman, c/o Aerovox Corp., New Bedford, Mass.

Engineers Council for Professional Development—Annual meeting, Engineering Societies Bldg., New York, N. Y., October 20. S. L. Tyler, secretary, 29 W. 39th St., New York 18, N. Y.

National Electrical Manufacturers Association — Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 23-27. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

National Association of Railroad and Utilities Commissioners—Annual meeting, Hotel Fontenelle, Omaha, Neb., November 14-17. Bert Smart, secretary, 7411 New Post Office Bldg., Washington 25, D. C.

Output Curve Drops Below 1943 Figure

For the first time this year, the output curve dropped below that of 1943 when the Labor Day weekend sent the electrical energy output for the week ended September 9, 1944, down to 4,227,900,000 kw.-hr. The September 11, 1943, figure was 4,229,262,000 kw.-hr.; so figures released by Edison Electric Institute ignore the slight decline and give the percent change from corresponding week of 1943 at 0.0 or none at all. For the week ended September 12, 1942, the output was 3,583,408,000 kw.-hr.

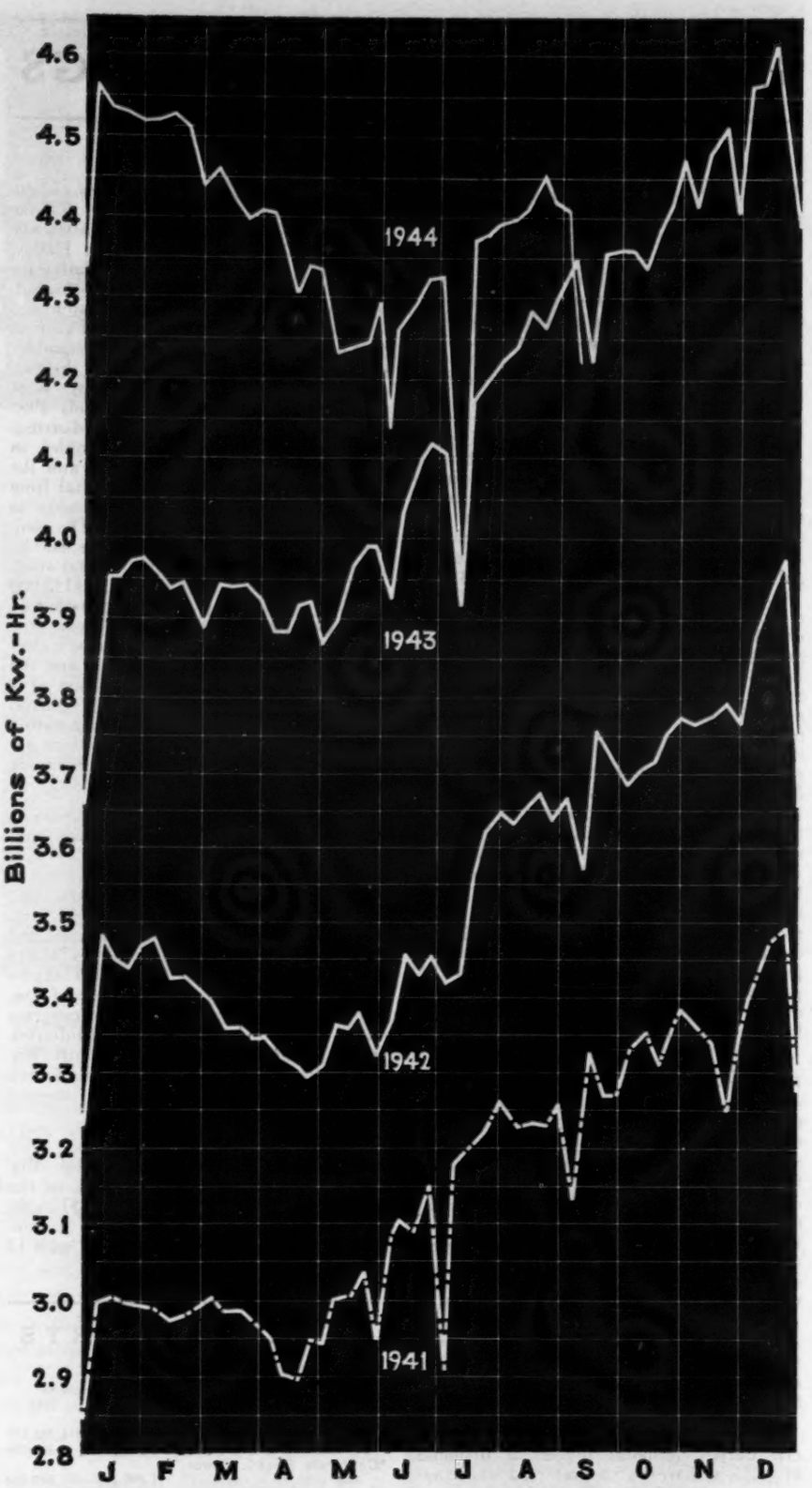
The Pacific Coast states continued their downward trend which they have been showing in recent weeks with only a plus 4.6 percent increase over the corresponding week of 1943. The Southern States showed an increase of 4.3 percent. The Middle Atlantic group with a decline of 6.2 percent and the Rocky Mountain group with a 5.8 percent decline were the only groups to show decreases. Other groups showed slight increases, none over 2.0 percent.

Weekly Output Millions Kw.-Hr.

1944		1943		1942	
Sept. 9	4,228	Sept. 11	4,229	Sept. 12	3,583
Sept. 2	4,415	Sept. 4	4,351	Sept. 5	3,673
Aug. 26	4,418	Aug. 28	4,322	Aug. 29	3,640
Aug. 19	4,451	Aug. 21	4,255	Aug. 22	3,674
Aug. 12	4,415	Aug. 14	4,288	Aug. 15	3,655
Aug. 5	4,399	Aug. 7	4,241	Aug. 8	3,637
July 29	4,391	July 31	4,227	Aug. 1	3,649
July 22	4,381	July 24	4,196	July 25	3,656
July 15	4,377	July 17	4,181	July 18	3,565
July 8	3,941	July 10	3,919	July 11	3,429
July 1	4,327	July 3	4,111	July 4	3,421
June 24	4,325	June 26	4,120	June 27	3,457

Percent Change from Previous Year

	Week Ending		
	Sept. 9	Sept. 2	Aug. 26
New England	+ 2.0	+ 2.5	+ 1.4
Mid Atlantic	— 6.2	— 5.9	— 5.2
Central Industrial	+ 0.1	+ 1.7	+ 1.6
West Central	+ 1.4	— 1.3	+ 2.3
Southern States	+ 4.3	+ 5.4	+ 7.1
Rocky Mountain	— 5.8	— 4.4	— 2.6
Pacific Coast	+ 4.6	+ 9.9	+10.5
Total United States	0.0	+ 1.5	+ 2.2



Canadian Output in July

In July, for the third successive month, the output of central stations in Canada was lower than that of the corresponding month in 1943. Figures released by the Dominion Bureau of Statistics show a July, 1944, production of 3,149,328,000 kw.-hr. as compared with 3,411,697,000 a year ago.

Primary power declined by 185,166,000 kw.-hr. or 6 percent, and secondary power by 77,203,000 kw.-hr. of 24.3 percent. However, during the seven months ending with July, total Canadian output was 23,678,493,000 kw.-hr. compared with 23,085,919,000 in the similar period of 1943.

WLB Denies Wage Increase

The War Labor Board has reaffirmed a decision of the Third Regional Board denying 1,800 employees of the Potomac Electric Power Co. a $5 a month raise. Both the company and the Electric Utility Employees' Union had appealed from the ruling made last March.

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission, in a series of orders recently issued affecting electric utility companies:

HAS APPROVED without alteration the plan for the reorganization of the $300,000,000 United Gas Corp., a subsidiary of Electric Power & Light Corp., which in turn, is a subsidiary of Electric Bond & Share Co. SEC counsel has applied to the Federal District Court at Wilmington, Del. for an order for the enforcement of the plan. Judge Paul Leahy signed an order setting a hearing on the plan on September 29. The plan briefly provides for the reorganization of United, and the elimination from its security structure of its entire existing debt, first and second preferred stocks, and the accumulated dividend arrearages thereon, aggregating a total claim on liquidation of $269,791,314. The only securities to be outstanding after the reorganization becomes effective will be $100,000,000 of first mortgage bonds and 10,653,302 shares of common stock, par $10, total par value $106,533,020. The new bonds have been exempted from competitive bidding and are to be sold to insurance companies and other institutional investors. Proceeds will be applied to paying $44,000,000 to Electric Bond & Share Co., the top unit, in satisfaction of its entire interest in United Gas, on the basis of 80 cents on the dollar, and to redemption of publicly held first preferred stock of United Gas. Electric Power & Light Corp., the immediate parent of United Gas Corp., will receive 94.9 percent of the reorganized company's common stock in exchange for its present holdings of second preferred and common stocks, and the 5.1 percent remainder of the United Gas common stock, will go to public holders of the latter's common stock.

HAS AUTHORIZED sale by Associated Electric Co. of all of its interest in the securities of its wholly-owned subsidiary, Ohio-Midland Light & Power Co., to three Ohio rural electric cooperatives for a base purchase price of $2,115,000 cash, subject to closing adjustments. The new purchasers of the Ohio-Midland securities are South-Central Rural Electric Co-op., Inc., Union Rural Electric Co-op., Inc., and Inter-County Rural Electric Co-op., Inc., which are borrowing the funds necessary for the transaction from the Rural Electrification Administration, pledging the Ohio-Midland securities and indebtedness to secure the loan. The sale was opposed by Columbus & Southern Ohio Electric Co., whose bid of $1,900,000 was rejected by Associated.

HAS APPROVED Commonwealth & Southern Corp.'s proposal to pay a dividend of $1.25 a share on its preferred stock, aggregating $1,852,500. The dividend is payable October 3 to stockholders of record September 19.

AUTHORIZED GENERAL GAS & Electric Corp. to pay out of capital or unearned surplus a quarterly dividend of $1.25 per share on its $5 prior preferred stock for the period ending Sept. 15, 1944.

APPROVED PROPOSED sale by West Coast Power Co., a subsidiary of Peoples' Light & Power Co. of all of its electric properties and assets in Idaho to Idaho Power Co. and related transactions. Idaho Power will pay $635,000 in cash for the properties, subject to closing adjustments. West Coast's water properties in Hailey, Idaho, will be sold to the city of Hailey for $65,000 in cash, also subject to closing adjustments. Related transactions approved include the redemption by West Coast of $386,000 face amount of its outstanding first mortgage bonds through use of the proceeds from the sale; payment by West Coast of a dividend of approximately $90,000 out of its earned surplus and a distribution of $450,000 in cash to Peoples in partial liquidation of West Coast, and the reduction of the latter's stated capital from $650,000 to $200,000 without an change in the number of outstanding shares. The commission also gave its approval to the sale by Peoples of all the outstanding capital stock of West Coast to A. E. Fimmel for $115,000 in cash, subject to closing adjustments. This sale is, however, contingent upon consummation of the sale of West Coast's electric and water properties in Idaho and the receipt by Peoples from West Coast of a dividend and a distribution in partial liquidation of the subsidiary aggregating not less than $500,000. The transactions are part of Peoples' allover plan of geographic integration.

AT THE REQUEST of Cities Service Power & Light Co. and four of its subsidiaries, has reduced from ten to six days the period for inviting bids on the issuance and sale by Empire District Electric Co., one of the subsidiaries, of $10,600,000 principal amount of first mortgage bonds, and the sale at competitive bidding by Cities Service Power & Light of 350,000 shares of the $10 par value common stock of Empire. The financing is part of the program under which the other three subsidiaries, Ozark Utilities Co., Lawrence County Water, Light & Cold Storage Co. and Benton County Utilities Corp., will be merged into Empire.

SANCTIONED SALE by Associated Electric Co. of the properties of the Missouri Southern Public Service Co. to the New-Mac Electric Co-op., Inc., for $170,000 cash. The properties are in Barry, McDonald and Newton counties, Mo. As part of the transaction, Missouri Southern will transfer to Associated Electric forty shares of capital stock of Atlantic Utility Service Corp., and its other remaining assets. Associated Electric will also surrender to Missouri Southern all its capital stock and indebtedness held by it, after which the subsidiary will be dissolved.

UTILITY REPORTS

	Net Income 1944	1943
*American Power & Light and subs.	$14,275,580	$16,288,576
*Arkansas Power & Light	1,292,610	1,353,795
*California Electric Power and subs.	1,295,199	1,049,524
*Dallas Power & Light	1,310,578	1,507,761
*Engineers Public Service and subs.	6,250,149	5,314,955
*Louisiana Power & Light	761,981	1,405,407
*Mississippi Power & Light	601,488	782,203
*New Orleans Public Service	1,523,336	2,203,247
*Northwestern Electric	523,235	709,994
*Pacific Power & Light	892,067	1,123,303
*Texas Electric Service	1,527,016	2,208,642
*Texas Power & Light	2,617,257	2,636,237
*Washington Water Power and sub.	2,874,779	2,997,299

*Twelve months ended July 31.

Hearings Scheduled

SEPTEMBER 19: On application of Arkansas Power & Light Co. for authority to issue and sell, pursuant to competitive bidding provisions of rule U-50, a total of $30,000,000 of first mortgage bonds to mature in 1974. Proceeds are to be used to redeem $30,000,000 of 5 percent first and refunding mortgage gold bonds, due 1956, at 102¾; $276,000 of 2.88 percent first and refunding mortgage gold bonds, due 1956, at 100 percent, and $185,000 of 2.73 percent first and refunding mortgage gold bonds, due 1959, at 100 percent. Arkansas, a subsidiary of Electric Power & Light Corp., proposes to reduce its annual interest requirements through the refunding program.

SEPTEMBER 21: For a hearing on Standard Gas & Electric Co.'s amended plan of reorganization. Under the amended plan, $59,202,200 in Standard notes and debentures would be retired with the new securities, cash and shares of common stock of Pacific Gas & Electric Co., Oklahoma Gas & Electric Co., California Oregon Power Co. and Mountain States Power Co.

SEPTEMBER 22: On application of Philadelphia Electric Co. for authority to issue and sell, subject to competitive bidding, two issues of $65,000,000 each of first and refunding mortgage bonds, 2¼ percent series, the first due in 1969 and the second in 1974. Proceeds from the sale of the bonds will be used to redeem $130,000,000 of the company's first and refunding mortgage bonds, 3½ percent series, due 1967, at the redemption price of 106 percent of principal amount, plus accrued interest.

SEPTEMBER 28: On amended plan of reorganization for Portland Electric Power Co. which was filed on August 28, 1944, by the Guaranty Trust Co. of New York as indenture trustee. The plan fixed the assets of the utility at $27,414,257. Revised upward by more than $8,000,000 over its earlier estimate, the plan was the only one submitted to the SEC by any of the interested parties within the sixty days allowed for that purpose beginning on July 1, the day the commission rejected four plans then before it. The plan, as amended by the Guaranty Trust, provides for dissolution of Portland Electric Power and its subsidiaries, the Cazadero Real Estate Co. and the Little White Salmon Land Co., and for creation of a new company to be known as the Realization Corp., with five directors initially appointed by the bankruptcy court to preside over the liquidation.

Surveys Petitcodiac River

Of the $50,000 cost of a technical survey of the tidal power possibilities of the Petitcodiac River, the Dominion and New Brunswick governments will bear equal shares. H. C. Acres, Toronto, specialist in water power engineering, is conducting an investigation during the fall months. The Dominion Department of Mines and Resources has been placed in charge of the survey.

How

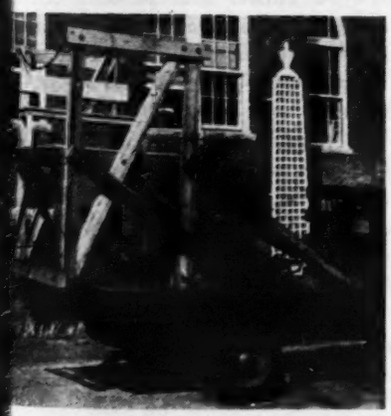
DESIGN · CONSTRUCT · OPERATE · MAINTAIN

ixture Painting Truck Platform at Boston

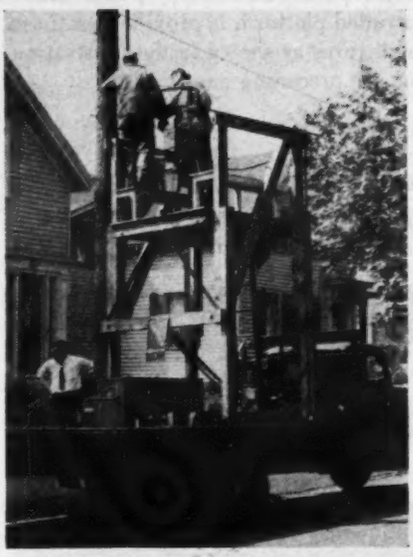
By D. B. HILL
quipment Service Division, Boston Edison Co.

A new type of platform for the safe, onvenient and economical painting f street lighting fixtures has been ecently designed, built and put in ervice by the Boston Edison Co. It onsists of a 1.5-ton truck with platorm body on which is built an elevating work area operating on the arallel folding rule principle.

The crew consists of a driver and wo linemen. The truck travels to the ork location with the elevating platorm locked in folded position with olts and wing nuts. On arrival at the ob the down locks are removed and a inch pulls the platform to its elevated osition. Four bolts with wing nuts hen lock the rigid legs and the folding gs of the platform firmly together. he linemen ascend a permanently attached ladder and let down a forward safety chain. The driver places the truck so that the street lamp and reflector are centrally located with regard to the platform. The safety chain is then snapped across the front opening and the two men paint from opposite sides of the bracket. When the job is completed, the rear safety chain is unsnapped and the truck moves on to the next unit, the linemen remaining on the platform in transit.



PLATFORM LOCKED in folded position during transit to job. Since this picture was made, a second seat and two pipe guard rails have been added to the platform for convenience and safety in reaching high brackets as shown in upper right illustration



PLATFORM ERECTED and linemen painting street lighting fixture. Note safety chains at ends of platform

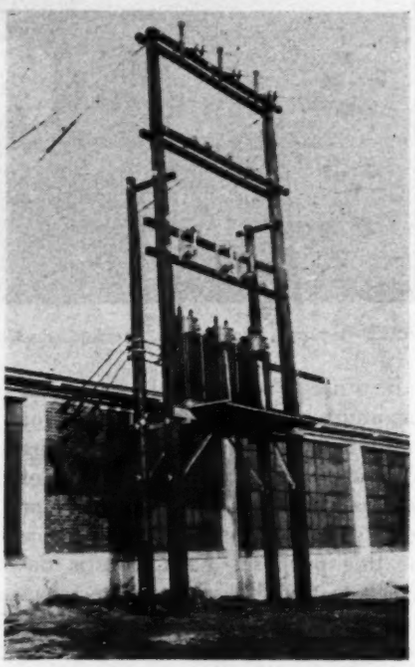
Principal Dimensions Street Lamp Fixture Painting Truck Platform

Truck: 1½ ton Ford with stake body (sides removed)
Working platform: 5′ x 5′
Platform elevated: 11½′ above ground
Platform lowered: 7½′ above ground
Platform seats: 18″ high, 12″ wide, 5′ long
Permanent guard rail: 3½′ above floor.
Safety guard rail: 3½′ above seats
Frame stock: 4″ x 6″ specifications, actual 3½″ x 5½″

Neat Low-Cost Power Bank Structure

The neat, compact, four-pole platform for power transformer banks illustrated is used on industrial premises by the Central Illinois Electric & Gas Co., Rockford, in preference to the more expensive and space-consuming alternative of mounting transformers on concrete pads within protective fence enclosures at ground level.

Banks of up to three 100-kva. units are mounted on two-pole structures of the conventional type. Larger banks, up to three 333-kva. units, are installed on the four-pole structures



FOUR-POLE platform for industrial power bank cuts cost, saves space compared with fenced installation at ground level. Note lighting bank (460-230v) on plant wall

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APPROVED PROPOSED sale by West Coast Power Co., a subsidiary of Peoples' Light & Power Co. of all of its electric properties and assets in Idaho to Idaho Power Co. and related transactions. Idaho Power will pay $635,000 in cash for the properties, subject to closing adjustments. West Coast's water properties in Hailey, Idaho, will be sold to the city of Hailey for $65,000 in cash, also subject to closing adjustments. Related transactions approved include the redemption by West Coast of $386,000 face amount of its outstanding first mortgage bonds through use of the proceeds from the sale; payment by West Coast of a dividend of approximately $90,000 out of its earned surplus and a distribution of $450,000 in cash to Peoples in partial liquidation of West Coast, and the reduction of the latter's stated capital from $650,000 to $200,000 without an change in the number of outstanding shares. The commission also gave its approval to the sale by Peoples of all the outstanding capital stock of West Coast to A. E. Fimmel for $115,000 in cash, subject to closing adjustments. This sale is, however, contingent upon consummation of the sale of West Coast's electric and water properties in Idaho and the receipt by Peoples from West Coast of a dividend and a distribution in partial liquidation of the subsidiary aggregating not less than $500,000. The transactions are part of Peoples' allover plan of geographic integration.

AT THE REQUEST of Cities Service Power & Light Co. and four of its subsidiaries, has reduced from ten to six days the period for inviting bids on the issuance and sale by Empire District Electric Co., one of the subsidiaries, of $10,600,000 principal amount of first mortgage bonds, and the sale at competitive bidding by Cities Service Power & Light of 350,000 shares of the $10 par value common stock of Empire. The financing is part of the program under which the other three subsidiaries, Ozark Utilities Co., Lawrence County Water, Light & Cold Storage Co. and Benton County Utilities Corp., will be merged into Empire.

SANCTIONED SALE by Associated Electric Co. of the properties of the Missouri Southern Public Service Co. to the New-Mac Electric Co-op., Inc., for $170,000 cash. The properties are in Barry, McDonald and Newton counties, Mo. As part of the transaction, Missouri Southern will transfer to Associated Electric forty shares of capital stock of Atlantic Utility Service Corp., and its other remaining assets. Associated Electric will also surrender to Missouri Southern all its capital stock and indebtedness held by it, after which the subsidiary will be dissolved.

Hearings Scheduled

SEPTEMBER 19: On application of Arkansas Power & Light Co. for authority to issue and sell, pursuant to competitive bidding provisions of rule U-50, a total of $30,000,000 of first mortgage bonds to mature in 1974. Proceeds are to be used to redeem $30,000,000 of 5 percent first and refunding mortgage gold bonds, due 1956, at 102¾; $276,000 of 2.88 percent first and refunding mortgage gold bonds, due 1956, at 100 percent, and $185,000 of 2.73 percent first and refunding mortgage gold bonds, due 1959, at 100 percent. Arkansas, a subsidiary of Electric Power & Light Corp., proposes to reduce its annual interest requirements through the refunding program.

SEPTEMBER 21: For a hearing on Standard Gas & Electric Co.'s amended plan of reorganization. Under the amended plan, $59,202,200 in Standard notes and debentures would be retired with the new securities, cash and shares of common stock of Pacific Gas & Electric Co., Oklahoma Gas & Electric Co., California Oregon Power Co. and Mountain States Power Co.

SEPTEMBER 22: On application of Philadelphia Electric Co. for authority to issue and sell, subject to competitive bidding, two issues of $65,000,000 each of first and refunding mortgage bonds, 2¾ percent series, the first due in 1969 and the second in 1974. Proceeds from the sale of the bonds will be used to redeem $130,000,000 of the company's first and refunding mortgage bonds, 3½ percent series, due 1967, at the redemption price of 106 percent of principal amount, plus accrued interest.

SEPTEMBER 28: On amended plan of reorganization for Portland Electric Power Co. which was filed on August 28, 1944, by the Guaranty Trust Co. of New York as indenture trustee. The plan fixed the assets of the utility at $27,414,257. Revised upward by more than $8,000,000 over its earlier estimate, the plan was the only one submitted to the SEC by any of the interested parties within the sixty days allowed for that purpose beginning on July 1, the day the commission rejected four plans then before it. The plan, as amended by the Guaranty Trust, provides for dissolution of Portland Electric Power and its subsidiaries, the Cazadero Real Estate Co. and the Little White Salmon Land Co., and for creation of a new company to be known as the Realization Corp., with five directors initially appointed by the bankruptcy court to preside over the liquidation.

UTILITY REPORTS

	Net Income 1944	1943
*American Power & Light and subs.	$14,275,580	$16,288,576
*Arkansas Power & Light	1,292,610	1,353,795
*California Electric Power and subs.	1,295,199	1,049,524
*Dallas Power & Light	1,310,578	1,507,761
*Engineers Public Service and subs.	6,250,149	5,314,955
*Louisiana Power & Light	761,981	1,405,407
*Mississippi Power & Light	601,488	782,203
*New Orleans Public Service	1,523,336	2,203,247
*Northwestern Electric	523,235	709,994
*Pacific Power & Light	892,067	1,123,303
*Texas Electric Service	1,527,016	2,208,642
*Texas Power & Light	2,617,257	2,636,237
*Washington Water Power and sub.	2,874,779	2,997,299

*Twelve months ended July 31.

Surveys Petitcodiac River

Of the $50,000 cost of a technical survey of the tidal power possibilities of the Petitcodiac River, the Dominion and New Brunswick governments will bear equal shares. H. C. Acres, Toronto, specialist in water power engineering, is conducting an investigation during the fall months. The Dominion Department of Mines and Resources has been placed in charge of the survey.

How

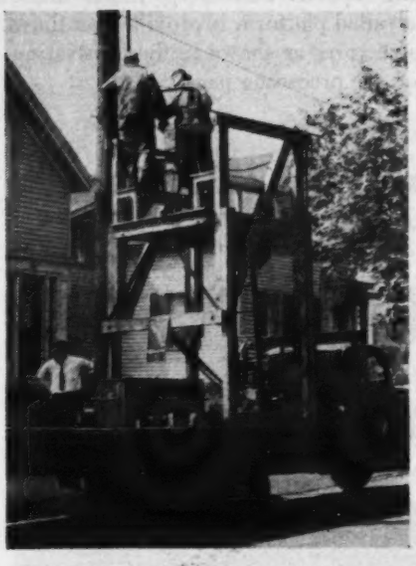
DESIGN · CONSTRUCT · OPERATE · MAINTAIN

ixture Painting Truck Platform at Boston

By D. B. HILL
quipment Service Division, Boston Edison Co.

A new type of platform for the safe, onvenient and economical painting f street lighting fixtures has been ecently designed, built and put in ervice by the Boston Edison Co. It onsists of a 1.5-ton truck with platorm body on which is built an elevating work area operating on the arallel folding rule principle.

The crew consists of a driver and wo linemen. The truck travels to the ork location with the elevating platorm locked in folded position with olts and wing nuts. On arrival at the ob the down locks are removed and a inch pulls the platform to its elevated osition. Four bolts with wing nuts hen lock the rigid legs and the folding gs of the platform firmly together. he linemen ascend a permanently attached ladder and let down a forward safety chain. The driver places the truck so that the street lamp and reflector are centrally located with regard to the platform. The safety chain is then snapped across the front opening and the two men paint from opposite sides of the bracket. When the job is completed, the rear safety chain is unsnapped and the truck moves on to the next unit, the linemen remaining on the platform in transit.



PLATFORM ERECTED and linemen painting street lighting fixture. Note safety chains at ends of platform

PLATFORM LOCKED in folded position during transit to job. Since this picture was made, a second seat and two pipe guard rails have been added to the platform for convenience and safety in reaching high brackets as shown in upper right illustration

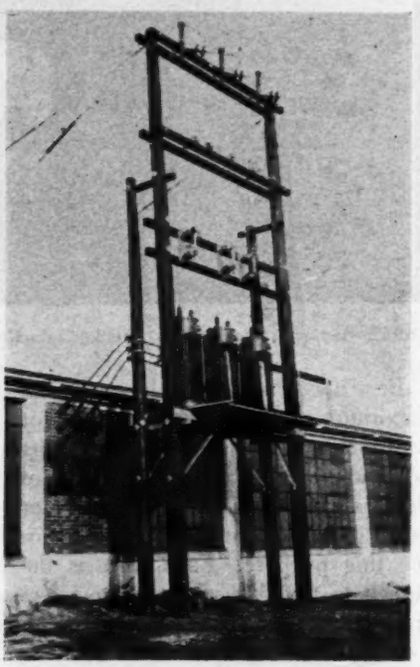
Principal Dimensions Street Lamp Fixture Painting Truck Platform

Truck: 1½ ton Ford with stake body (sides removed)
Working platform: 5′ x 5′
Platform elevated: 11½′ above ground
Platform lowered: 7½′ above ground
Platform seats: 18″ high, 12″ wide, 5′ long
Permanent guard rail: 3½′ above floor.
Safety guard rail: 3½′ above seats
Frame stock: 4″ x 6″ specifications, actual 3½″ x 5½″

Neat Low-Cost Power Bank Structure

The neat, compact, four-pole platform for power transformer banks illustrated is used on industrial premises by the Central Illinois Electric & Gas Co., Rockford, in preference to the more expensive and space-consuming alternative of mounting transformers on concrete pads within protective fence enclosures at ground level.

Banks of up to three 100-kva. units are mounted on two-pole structures of the conventional type. Larger banks, up to three 333-kva. units, are installed on the four-pole structures



FOUR-POLE platform for industrial power bank cuts cost, saves space compared with fenced installation at ground level. Note lighting bank (460-230v) on plant wall

shown. In these cases the two short poles are added to provide bearing surface to carry the extra weight.

Of the four poles in such structures, the two longer ones are 50-ft. class three; the shorter ones 35 ft. class three poles. Butts of the two poles at each end of the structure rest on narrow oblong pads of concrete 2-ft. thick, 7 ft. below grade. Poles resting on these pads are spaced 30 in. apart on centers.

Main structural steel beams supporting the bank are 8 in. channels. Fittings for the structure, including the treated timber cross arms are supplied by Hughes Brothers, to specifications developed by J. J. Graven, distribution engineer at Rockford.

To get away from the more expensive dead-end secondary bus construction, common to similar structures, this company uses conventional secondary racks bolted to the back of the structure between the "short" poles. To neutralize torsional strain on the racks where service conductors are of the order of 500 Mcm, scrap cross arm braces are used. These braces, are given a 90 deg. twist and lagged to the pole at one end. The other end is threaded by the vertical rack bolt.

For the safety and convenience of linemen replacing the high interrupting capacity De-ion-type power fuses, a railed platform is provided on these structures as shown in the illustration on the preceding page.

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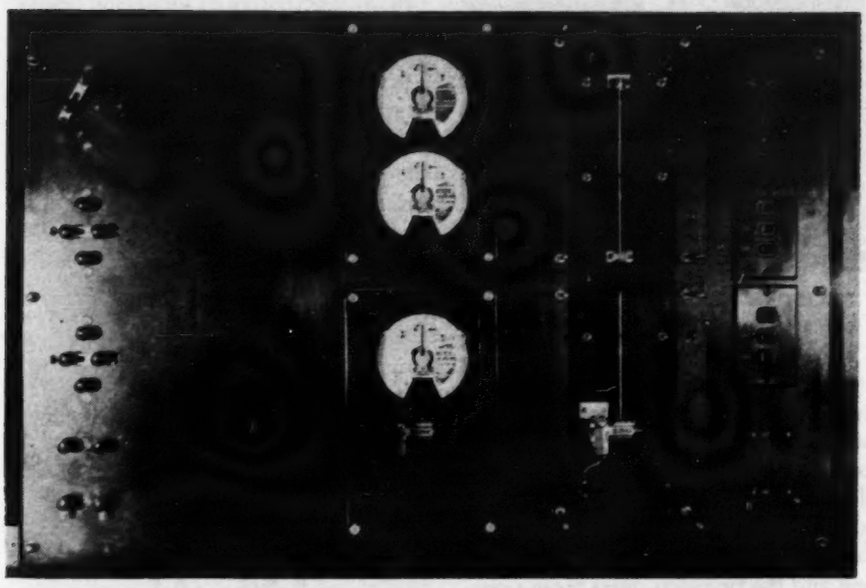
Gang-Tests Maximum Demand Registers

By SAM SILVERMAN
Los Angeles Department of Water and Power



THREE demand attachments checked simultaneously against synchronous motor

In order to speed up the testing of maximum demand attachments for watthour meters without sacrificing accuracy, the Testing Laboratories of the Los Angeles Department of Water and Power designed a special device for this purpose. Each unit is designed to test three demand registers simultaneously. A synchronous motor is geared to a vertical shaft which drives the three demand registers at a known fixed speed. When the three attachments are of the same ratio, both the kilowatt and kilowatt-hour readings, after a period of time, should all coincide exactly. By knowing the speed of the shaft and the elapsed time, the correct readings can easily be calculated. The three attachments are mounted in a vertical line, giving a pleasing unit appearance and conserving switchboard space. Switches are installed on the side of the panel to control the circuits to the synchronous motors driving the shafts, to control the timing motors on the demand attachments themselves and to energize both sets of circuits at 120, 240 and 480 volts from corresponding terminals at the left.

Prevents Contamination of City Water

When a city water connection is made as an emergency standby in case of failure of locally-pumped water for power plant services, there is danger of contamination of the city supply by leakage through the connection valve. This is avoided in the Walnut Ave. plant of the Appalachian Electric Power Co., in Roanoke by holding the connection actually unmade until occasion arises to use it. At the place where the city water will, when required, be tapped into the power plant system, two valves are installed with a union joint between them. One valve closes off the city water and the other the power plant supply. When it is necessary the union joint is closed and the two valves are opened, letting the city water in. But until that time comes there is no danger of contamination of the city water.

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Field Test Kit For A. C. Network Relays

By W. B. RICE
Asst. Engineer and W. J. Smith,*
Testing Department
Commonwealth Edison Co., Chicago

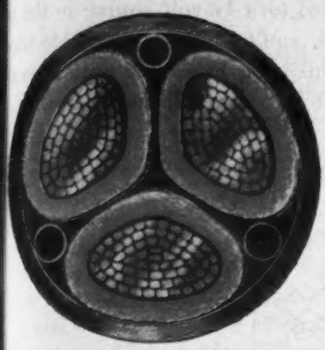
To facilitate periodic field testing of relays on the Chicago a.c. network system the testing department of the Commonwealth Edison Co. has designed and built a two-man test kit for operation from a panel truck. The kit permits a calibration check of network master and phasing relays connected to protectors on the three-phase, four-wire, 208-volt network. The protectors are operated as part of the relay test.

As many as nine protectors with their relays have been checked by two men in one eight-hour day using this kit. Over the period of the routine check the average is 5½ protectors per day.

Calibration of the network master relay requires an in-phase voltage across the open protector on each phase, for the closing check. The tripping check requires a current through the protector that is at 180 deg. to the voltage in order to trip the relay. Master relay contacts are required to close when the star trans-

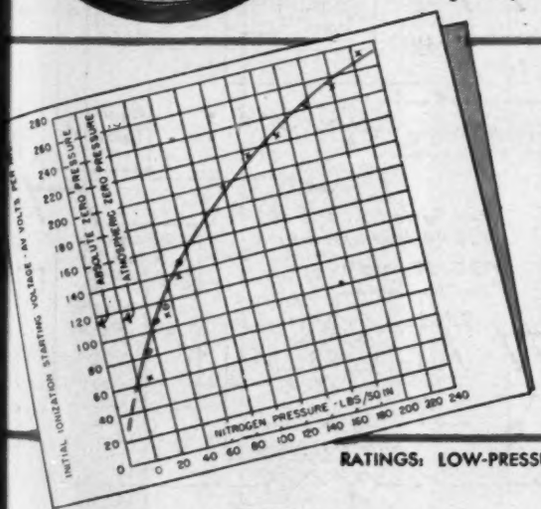
* Asst. Engineer & Engineer, respectively, Testing Department

How "AUTOMATIC GRADING" adds to the strength of G-E mass-impregnated gas-filled cable



CONTROLLED GAS PRESSURE begins its contribution to this strong, self-protected cable right at the treating tank. After impregnation, drainage of surplus compound takes place in a regulated atmosphere of nitrogen gas, until a capillary balance is reached. Under these conditions, more compound is held in the inner zone near the conductor than in the outer zone. Significantly, as the red shading of the cross-section shows, this distribution of compound corresponds to the distribution of electrical stress outward from the conductor.

UNDER VOLTAGE STRESS, a further strengthening effect occurs. In G-E gas-filled cable, the impregnating compound is carefully selected to be sufficiently viscous to stay in place without bleeding freely, and yet be sufficiently mobile to be moved by electrostatic action. Voltage stress acts by electrostatic attraction to draw this mobile compound into the voids and butt spaces where the stress is greatest, rearranging the distribution of the compound in the cable cross-section so that all critical points of high stress (such as at sector edges A) are strengthened. The combined effect of capillary action and voltage stress is called *automatic grading.*



THE SAFE LIMITS of a cable's dielectric strength are indicated by persistence of ionization. In G-E gas-filled cable, however, incipient ionization is (1) *suppressed* by the controlled pressure (see chart), and (2) *self-extinguished* by automatic grading and by an effect known as "self-healing action" from "X-wax" formation.

The self-supervising feature, which warns of sheath damage, and this *self-protecting ability* help explain why we regard mass-impregnated gas-filled cable as tomorrow's universal cable-type, within its recommended voltage range. ***General Electric Company, Schenectady 5, N. Y.***

RATINGS: LOW-PRESSURE TYPE, 10 TO 40 KV; MEDIUM-PRESSURE TYPE, 40 TO 69 KV

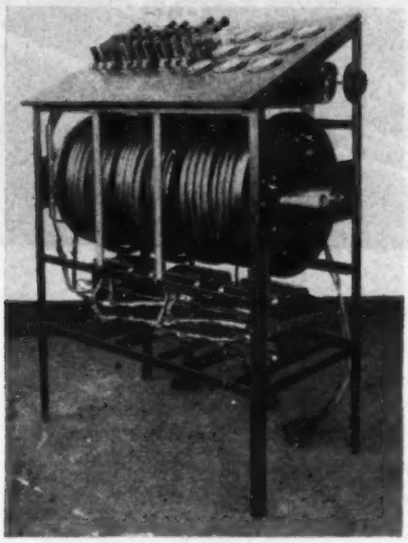
GENERAL ELECTRIC

501-23-1200

BUY ALL THE BONDS YOU CAN—AND KEEP ALL YOU BUY

former voltage is one volt or more higher than the star network voltage. Magnitude of the tripping current varies with the size of the protector and local load conditions.

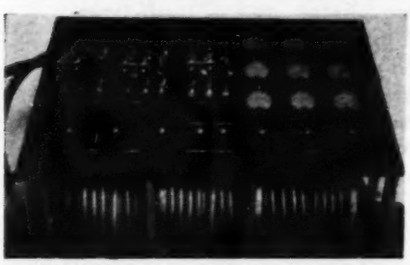
To calibrate the network phasing relay it is necessary to apply a voltage



FIELD KIT for testing relays on three-phase, four-wire, 208-volt network

across that phase of the protector which includes the phasing relay. This voltage must be at 90 deg. to the star network voltage, either leading or lagging, and from 0.5 to 1.0 volt in magnitude. The direction and value depend on the required relay setting.

The test kit that makes these tests consists of three 200-va. two-ratio (15:1 and 50:1) transformers, a three-gang variable-ratio auto transformer, six ammeters, three voltmeters, 150 ft. of No. 6 two-conductor stage cord and enough switches to make the various tests.



CLOSE-UP of switchboard panel of relay test kit illustrated above

Meters and switches are mounted on a Bakelite panel. The 150 ft. of cord is divided into three lengths of 50 ft. each and mounted on a polarized reel. Leads are brought out in pairs to avoid confusion. Leads on the reel are connected to the switchboard panel through standard 50-amp. range plugs.

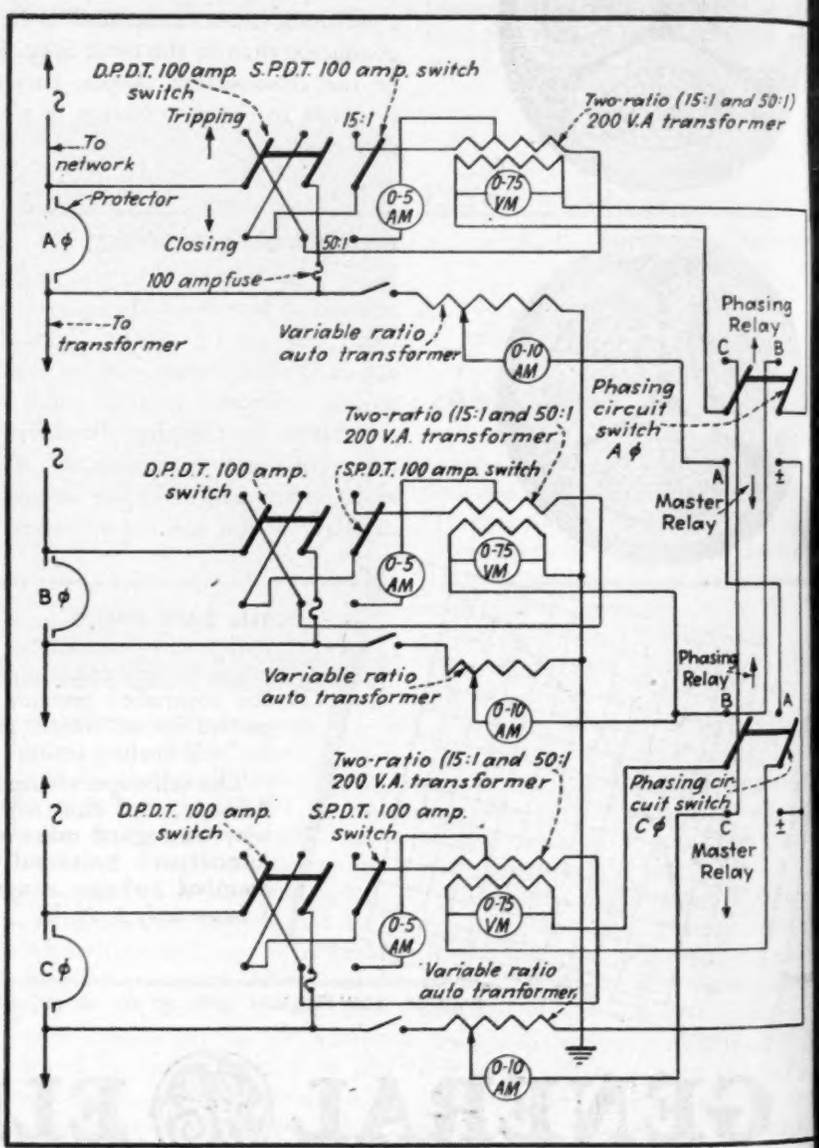
To provide a ground for the truck and test kit, a ground lead is brought out from the truck and grounded to the network vault.

Range for Tripping Check

The three double-ratio transformers provide a range of 0-100 amp. for the 180-deg. tripping check. The 15:1 ratio is used for settings from 5 amp. to 100 amp. The 50:1 ratio is used for sensitive tripping settings and for the closing checks on the network master and phasing relays. Diagram shows the test kit connected to a protector ready for test.

To prepare the protector for test it is only necessary to remove the fu that connect it to the network apply the proper pair of leads each phase of the protector. The n work transformer is left alive and the source for the test kit.

Two men are required to oper the test kit; one at the kit, the ot to watch the relays and protectors the network vault. A two-way speak system permits the operator in truck to speak with the tester in network vault. This speaker, ho ever, is not part of the test kit. Lig and power for the truck and speak system is provided by a pair of lea brought out from the truck and co nected to a 10-volt source in the n work vault. A small portable mo of this kit is in use for protectors th can't be reached from the truck.



SCHEMATIC diagram of relay test kit connected to a network protector

Electrical World Survey Shows INDUCTION REGULATORS in 1st PLACE

for getting the voltage up and holding it there

Survey of distribution trends recently completed by "Electrical World" was reported in the June 24 issue, with the following comments:

> "Delivery of adequate and appropriately sustained voltage is a primary index of the adequacy of distribution and it is significant that the induction regulator held first place before the war and will retain the lead after the war as a means of getting the voltage up and holding it there .... It outstrips all other approaches to sustained voltage adequacy for the postwar period."

HERE are some of the reasons for the continued popularity of induction regulators:

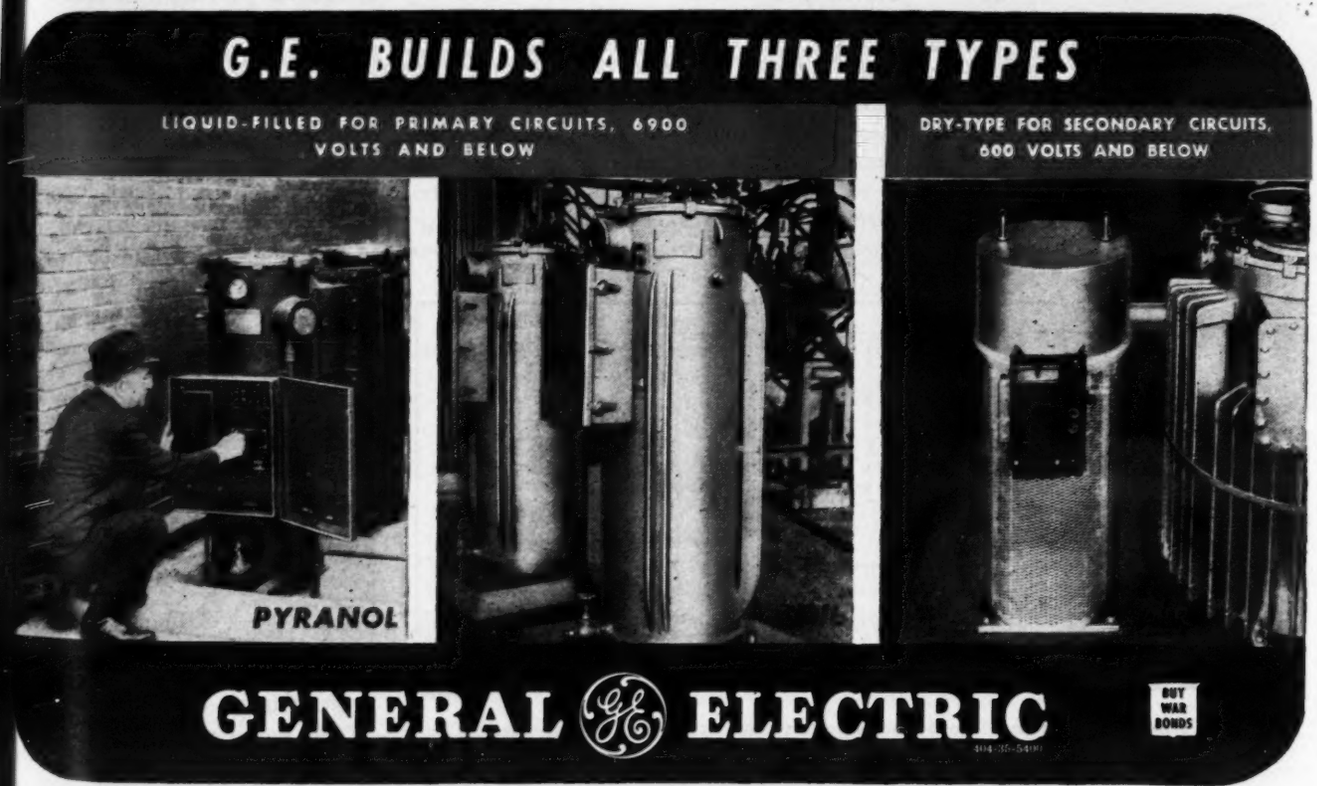
No time delay. Induction regulators act immediately to either raise or lower the voltage as soon as a voltage fluctuation reaches the edge of the band for which the controls are adjusted. Regulators which require a time-delay mechanism cannot act until the *average* voltage has been outside the band-width setting for a time equal to the time delay.

Narrow band width. The narrow band width makes possible a higher average voltage level without exceeding allowable maximum values. This results in (a) savings of revenue otherwise lost due to low voltage at time of peak load, (b) increased load-carrying ability, (c) longer feeders.

Low maintenance cost. The simplicity of the operating mechanism—the direct-gear drive, and the dynamic braking that does away with springs, latches, and snap-action mechanisms—permits a practically unlimited number of operations without increasing the very low maintenance cost.

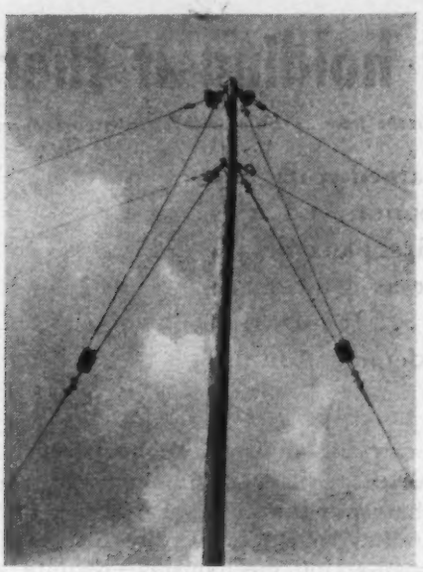
Dependable performance. The induction regulator has established a record of more than 40 years of excellent performance under all conditions of operation.

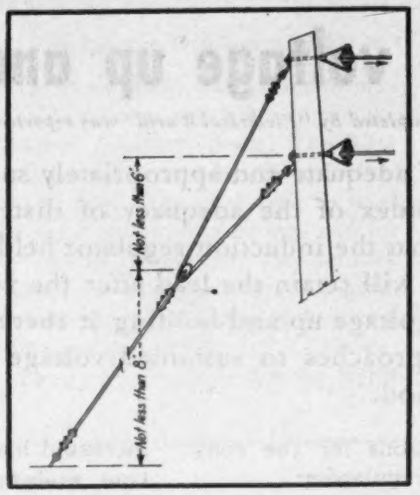
Ask your G-E representative to estimate the results you can obtain on your feeders. Or write for Catalog GEA-2742C. *General Electric Company, Schenectady 5, N. Y.*


G.E. BUILDS ALL THREE TYPES
LIQUID-FILLED FOR PRIMARY CIRCUITS, 6900 VOLTS AND BELOW
DRY-TYPE FOR SECONDARY CIRCUITS, 600 VOLTS AND BELOW
PYRANOL
GENERAL ELECTRIC
BUY WAR BONDS

Bridle Guy Keeps Poles From Bowing

To combat the tendency of light rural line poles to "bow" where corners are held by conventional single guys fastened to the top of the pole, the bottom conductor. A conventional down guy threads the strain insulator and connects to an earth anchor in the usual manner. While the bridle "short





BRIDLE GUY (left) keeps rural line corner poles from bowing (details above)

Wisconsin Power & Light Co., Madison, uses the illustrated "bridle" guy on single-phase lines. The bridle consists of a continuous piece of guy strand passing from a fitting near the top of the pole, through a "ball" type guy strain insulator, and back up to an eye bolt or similar fitting opposite circuits" the intervening wood between the phase conductor and grounded neutral wire and so detracts somewhat from the impulse strength of the structure, on the other hand, its use has been found to reduce the tendency of lightning strokes to shatter the pole.

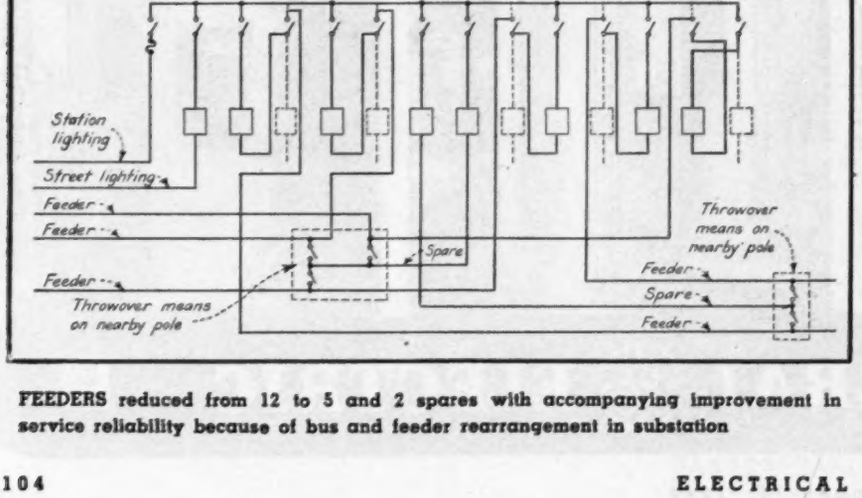
• • •

Simplification Pays Out in Breakers

When the East Tennessee Light and Power Co. acquired the system of a city in its service area, engineers of the company undertook to improve the bus and feeder arrangement in the main substation. Each of the feeders took off from a main bus through one set of disconnecting switches and an oil circuit breaker and then out into the streets. To remove a breaker for maintenance, or if a breaker failed, that feeder was out of service until the breaker restored. There were no spare alternate feeds except as prim might be cut over from one f area to another.

After investigation showed none of the feeders was he loaded the remedy for the cond was apparent; reduce the numb feeders. They were reduced, n one half, but to one less than five in place of twelve. This permitted the removal of oil circuit breakers for use where and a rearrangement w put disconnecting switches on side of the feeder breakers.

The accompanying diagram s the revised set-up which permits of the feeders to be served from spare and three from the other. T any feeder breaker may be by-pa and cut out entirely as may be quired for maintenance or caused trouble. Previous connections of five breakers removed are shown dotted lines on the diagram.



FEEDERS reduced from 12 to 5 and 2 spares with accompanying improvement in service reliability because of bus and feeder rearrangement in substation

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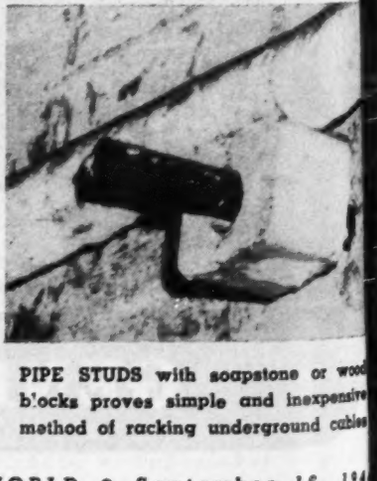
Method of Racking Cabl

Of the many systems and means racking cables in manholes, Pac Gas and Electric Co. likes the sys illustrated. Three-quarter-in. p studs are set in the concrete at time of pouring, or installed later drilling a ¾-in. hole in the concr and driving the ¾-in. pipe into hole. Standard soapstone blocks hardwood blocks, with saddle for cable, are then placed on the supp studs as shown.

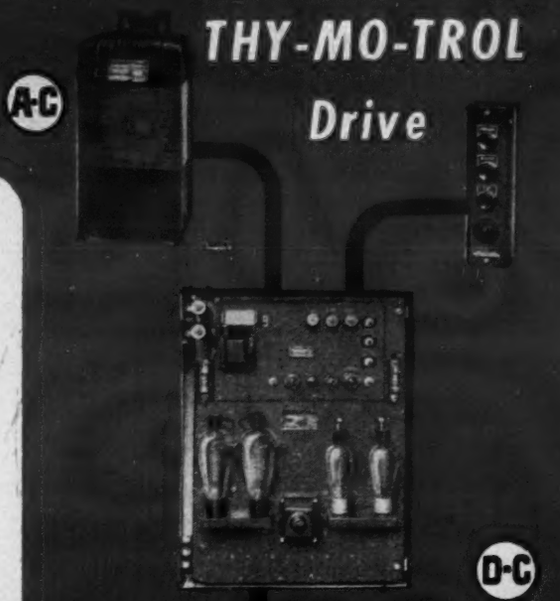
The illustration shows a single kv. cable installation. Secondary wi in transformer vaults are also rac in like manner. This method is s to be simple, flexible and inexpensi



PIPE STUDS with soapstone or wood b'ocks proves simple and inexpensive method of racking underground cables

CONSTANT SPEED EVEN WITH CHANGING LOADS

--ANOTHER Advantage of THY-MO-TROL Drive



What it means to machine users

MAINTAINED PRODUCTION because the speed of the motor does not fall off appreciably as the load on the machine increases.

IMPROVED QUALITY OF WORK because Thy-mo-trol drive provides the *correct operating speed,* and holds it.

NEED FOR GEAR CHANGING OFTEN ELIMINATED because Thy-mo-trol drive makes possible a wide speed range—ratios of 100:1 or greater can be provided.

ACCURATE SPEED CONTROL. Speed is held constant at the level the operator selects for each operation needed.

Standard Thy-mo-trol drives hold speed very closely, even though the load varies from no load to full load, because the electronic circuits automatically compensate for the voltage drop within the motor (which varies according to the load). For example, if the compensation adjustment is set for flat speed regulation at 10 per cent of basic speed, the regulation will be within 2 per cent when the drive is operated at basic speed (assuming constant motor temperatures).

When regulation better than that provided by the standard Thy-mo-trol drive is required, the addition of a tachometer generator affords speed regulation within one-half of 1 per cent.

A COMPLETE DRIVE. Thy-mo-trol drive takes a-c power from your supply line and, through its d-c motor, delivers torque to your load over a wide range of speeds. Starts, accelerates, controls speed, stops by dynamic braking, and reverses the motor—all from a single control station.

Standard drives can be obtained in ratings from 1/8 to 15 hp—higher or lower if needed.

HOW TO BUY THY-MO-TROL. Just give our local office complete information about your requirements—nature of the load, speed range, horsepower, etc. Then, our engineers will select just the right Thy-mo-trol drive components, to give you exactly the operating characteristics you want.

WANT COMPLETE INFORMATION?
Send this coupon for new bulletin.

General Electric Company, Section R668-14
Schenectady 5, N. Y.

Please send me a copy of Bulletin GEA-4025, which tells what Thy-mo-trol drive will do, what it has done, and how it works.

Name .....

Company .....

Address .....

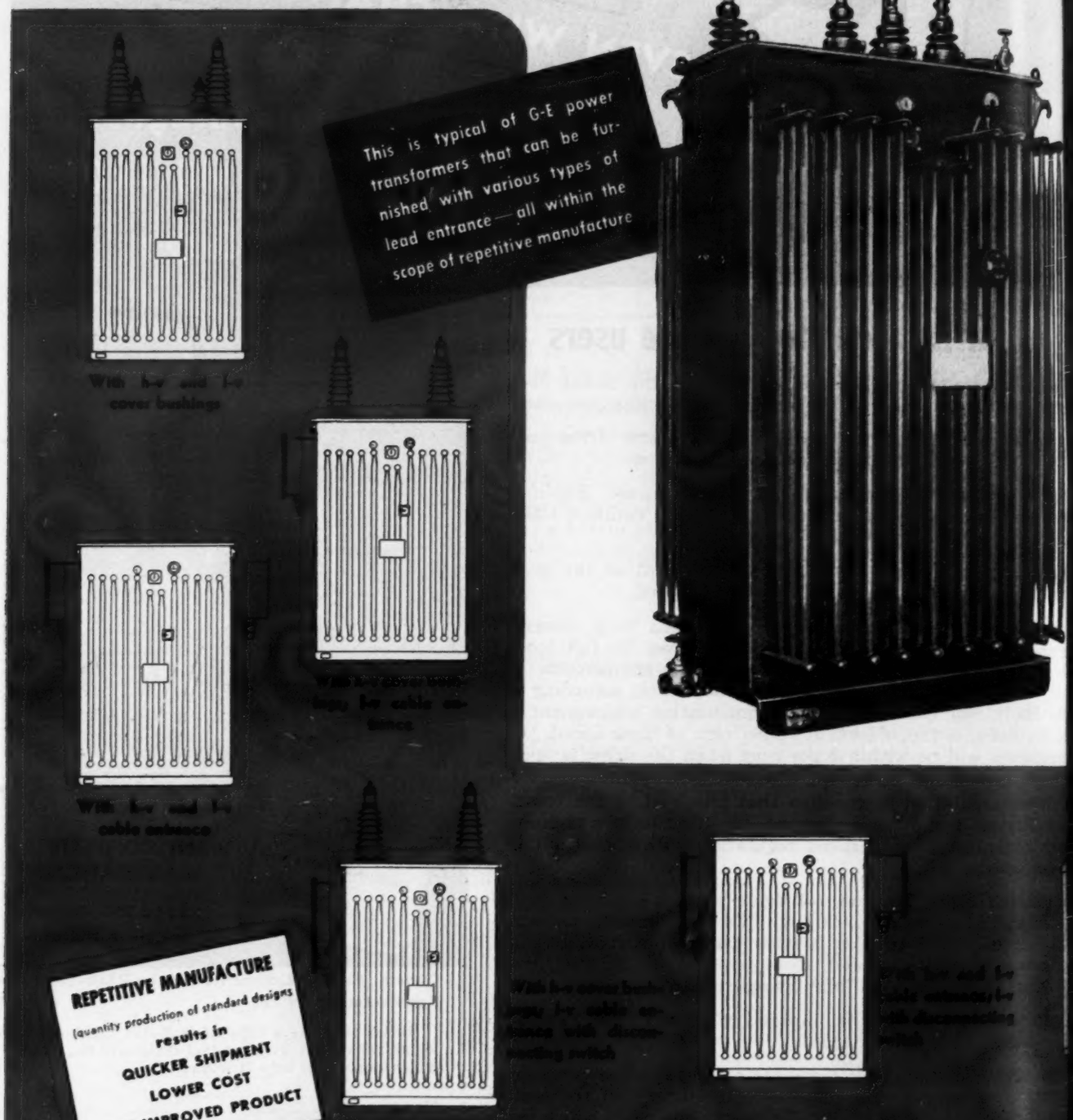
.....

8900

BUY WAR BONDS

GENERAL ELECTRIC

See what a wide variety of can be met with REPETITIVE-


This is typical of G-E power transformers that can be furnished with various types of lead entrance—all within the scope of repetitive manufacture
With h-v and l-v cover bushings
With h-v cover bushings, l-v cable entrance
With h-v and l-v cable entrance
With h-v cover bushings, l-v cable entrance with disconnecting switch
With h-v and l-v cable entrance, h-v with disconnecting switch
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results in
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REPETITIVELY manufactured power transformers offer great flexibility as to methods of installation, as evidenced by the various lead entrances and the combinations into unit substations, shown. Also, repetitive-manufacture transformers can be used on many jobs where "specials" have heretofore been considered necessary, such as parallel operation and delta operation with transformers already installed.

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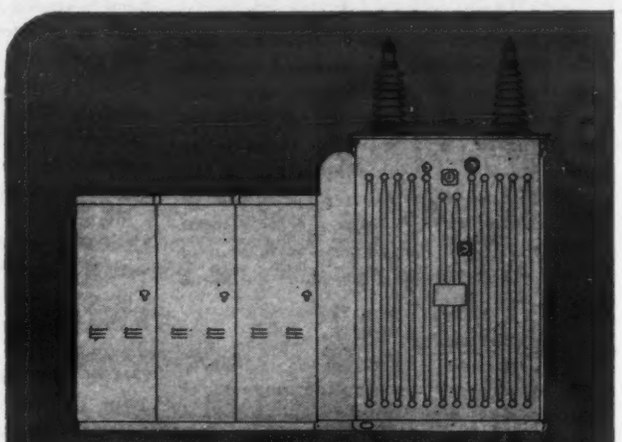

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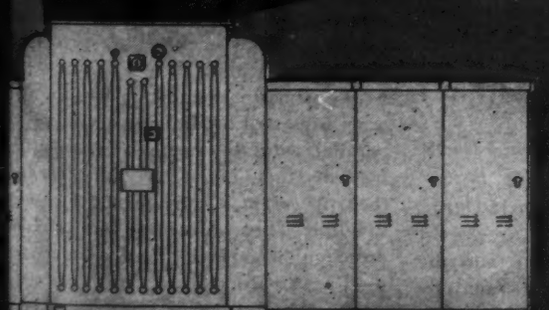
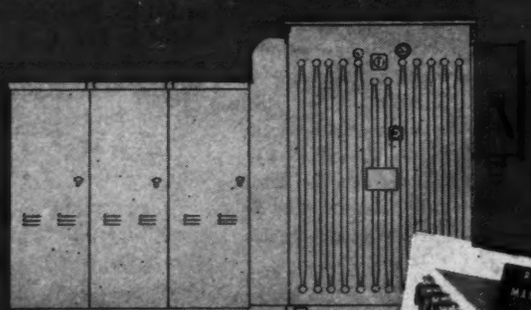
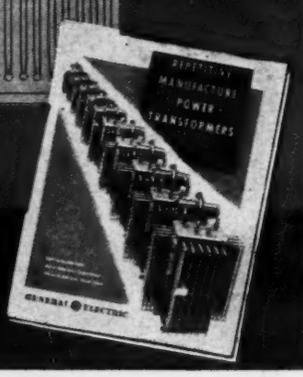


In unit substation arranged for 5-kv circuit breakers



In unit substation arranged for 5-kv cable entrance with disconnecting switch



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Ask for your copy of this booklet on RM-listed transformers, GEA-4283

STRESS CALCULATIONS FOR POLE LINE STRUCTURES—IV*

By CARL G. ERICKSON, Electrical Engineer, Northern Indiana Public Service Co., Hammond, Ind.

As a continuation of the stress calculations for wood pole transmission structures, this article covers two-pole structures with bracing near the top. Previous articles have covered single poles and bottom-braced two-pole structures. Subsequent articles in this series will be on two-pole structures with other forms of bracing, also a three-pole structure with cross bracing.

Two-Pole Structure With Bracing Near Top

Among the more common wood pole transmission structures in use today is the two-pole structure with bracing near the top. The accompanying Fig. 4 (a) shows such a structure with conventional "X" bracing located in the usual manner.

Horizontal loads applied at the cross arm as shown tend to distort this structure as shown in Fig. 4 (b). The line "a"—"a" indicates the assumed location of the plane of contraflexure, the plane at which there is a reversal of curvature in the poles and at which there is no bending stress. Referring to Fig. 4 (c) which is a graphical representation of the method of calculating the location of the plane of contraflexure, it is evident from the similar triangles that this plane is where:

$$h_1 = \frac{h \times M_G}{M_G + M_B}$$

M_G and M_B are the resisting moments of the pole at the ends of one unbraced section; in this case at the ground line and at the bottom ends of the braces respectively. Where there is a possibility of a slight side movement of the poles at the ground line the plane of contraflexure should be lowered by an amount equal to, say, 10 percent of the value of h_2.

For loads and dimensions above the plane of contraflexure as shown in Fig. 4 (d) forces and reactions may be determined as follows from relationships developed in the third article of this series.

$$R_1 = \frac{\left(\frac{P}{2} + \frac{P}{2}\right)h}{X} - \left(\frac{W}{2} + W_1\right)$$

$$= \frac{(1{,}000 + 1{,}000) \times (20 + 12 + 4)}{12} - (2{,}000 + 0) = 4{,}000 \text{ lbs.}$$

$$R_2 = \frac{\left(\frac{P}{2} + \frac{P}{2}\right)h}{X} + \frac{W}{2} + W_1$$

$$= \frac{(1{,}000 + 1{,}000) \times (20 + 12 + 4)}{12} + (2{,}000 + 0) = 8{,}000 \text{ lbs.}$$

$$H_1 = H_2 = \frac{P}{2} = 1{,}000 \text{ lb.}$$

In calculating R_1 and R_2, above, W_1 has been assigned a value of zero for convenience. However, in actual design one-half the weight of the structure above the plane of contraflexure should be considered. While Fig. 4 (d) represents a distorted structure it is assumed, for the purpose of these calculations, that actually the structure is rigid.

Force H_2 of 1,000 lb. tends to rotate clockwise about joint "a", Fig. 4 (d), with a moment arm of 20 + 12 or 32 feet. The moment equals 32 × 1,000 or 32,000 ft.-lb., which is resisted by the end of a diagonal brace at joint "b" which is 12 feet away from "a". Hence the force at joint "b" in a direction to the left is 32,000/12 or 2,667 lb. Also about joint "a" load P/2 of 1,000 lb., tends to rotate in a clockwise direction with a resulting force at joint "b" of [(1,000 × (4)] /12 or 333 lb. Both of these forces have been added to Fig. 4 (e) at joint "b". Similarly, taking moments about joint "b" and showing the results at joint "a" Fig. 4 (e) we have:

[(12 + 4) × (1,000)] /12 = 1,334 lb.
and (1,000 × 20) /12 = 1,667 lb.

Horizontal forces, for symmetrical structures, at joints "a", "b", "c", "d", should always be equal to each other, and the forces at joints "a" and "c" should be opposite in direction to those at joints "b" and "d".

With further reference to Fig. 4 (e), tension "t" and compression "c", in cross braces T and C respectively is by inspection:

$$t = c = \frac{3{,}000}{\sin \theta} = \frac{3{,}000}{0.707} = 4{,}243 \text{ lb.}$$

The maximum bending moments of the poles at joints "a", "b", "c", and "d", Fig. 4 (d) will be designated M_a, M_b, M_c, and M_d respectively:

$M_a = M_c = 4 \times 1{,}000 = 4{,}000$ ft.-lb.
$M_b = M_d = 20 \times 1{,}000 = 20{,}000$ ft.-lb.

The maximum bending moment of the poles at the ground line, see Fig. 4 (f), is 40 × 1,000 = 40,000 ft. lb.

The vertical reactions at the ground line would be the same as those shown in Fig. 4 (d) except each one would be increased by an amount W_1 equal to one-half the weight of the structure, in this example say 2,000 lb. It should be noted that in Fig. 4 (d), R_1 indicates reaction against uplift and R_2 indicates reactance against downward thrust. Hence, see Fig. 4 (f):

$R_1 = 4{,}000 - 2{,}000 = 2{,}000$ lb.
$R_2 = 8{,}000 + 2{,}000 = 10{,}000$ lb.

The use of stress diagrams makes easier the determination of stresses in the more complicated structures. In Fig. 4 (g) we have a load diagram for the figure shown in Fig. 4 (e) plotted to scale. Vertical and horizontal forces are shown.

Starting with the letter O, a letter is placed between each pair of arrows representing forces and reactions, proceeding in a clockwise direction. A letter is also placed within each polygon formed by the structure members. The stress diagram is started by drawing a vertical line parallel with the vertical middle of the load diagram, Fig. 4 (h). Position O is then placed in a convenient location on this line. Then proceeding in a clockwise direction around the load diagram and plotting the loads to any convenient scale on the stress diagram, we have:

From	to	lb.
O	A	= 4,000 vertically downward
A	B	= 3,000 horizontally to left
B	C	= 3,000 horizontally to right
C	D	= 2,000 vertically downward
D	E	= 2,000 vertically downward
E	F	= 3,000 horizontally to right

*This series began in *Electrical World*, May 13, 1944, issue.

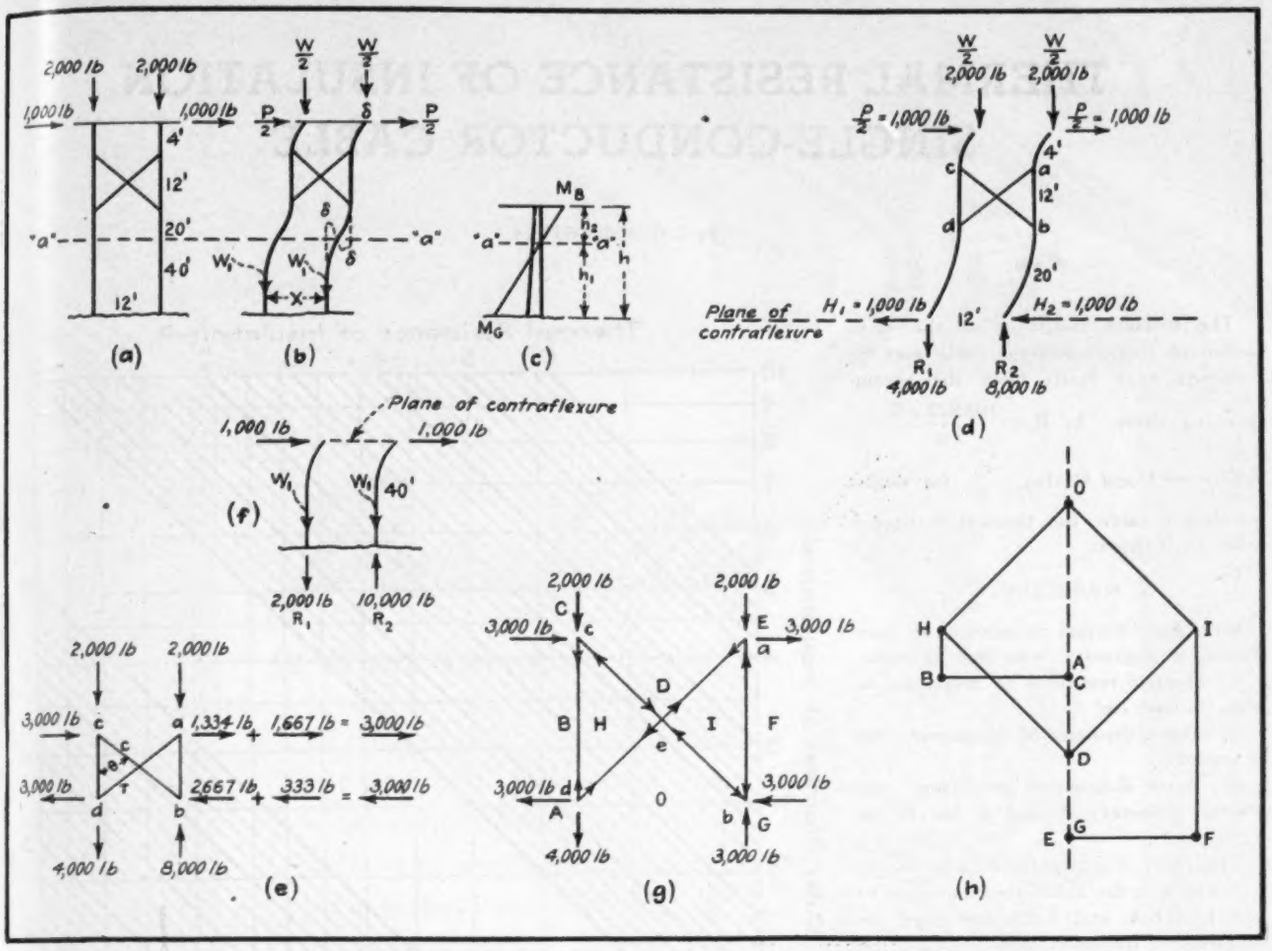


Fig. 4.—Load and stress diagrams for two-pole structure with conventional cross bracing near the top

F G = 3,000 horizontally to left
G O = 8,000 vertically upward

Referring again to the load diagram and proceeding from B to H we must cross a vertical line representing member B-H, therefore, a vertical line is drawn through point B on the stress diagram and point H must be somewhere on this line. From H to O on the load diagram a diagonal line must be crossed. If a diagonal line is drawn on the stress diagram through point O and parallel to line H-O on the load diagram it will intersect line B-H at point H. Then line B-H on the stress diagram represents the value of stress to scale of member B-H on the load diagram. Similarly line I-F on the load diagram indicates that a vertical line through F on the stress diagram will intersect a line drawn from O parallel to O-I on the load diagram at point I. If a line is drawn on the stress diagram from D to I it will be parallel to D-I on the load diagram at point I. If a line is drawn on the stress diagram diagram from D to I it will be paralel to line D-I on the load diagram. Line D-H on the stress diagram can be determined in like manner. By scaling the stress diagram it will be found that:

Member	*Stress, Lb.*
B-H	1,000
H-O	4,300
O-I	4,300
I-D	4,300
H-D	4,300
I-F	5,000

Consider joint "d" Fig. 4 (g). If we go about this joint in a clockwise direction from B to H we find from the stress diagram that we must go in a vertically upward direction. Place an arrow indicating that direction on member B-H on the load diagram. Using the same procedure it is found that the arrow points in a diagonally upward direction to the right near joint "d" for member H-O. If we continue this method for stress arrows for each member about joints a, b, c, d, and e, on the load diagram always working in a clockwise direction about the joints, we will have each member marked with direction arrows as shown. For each member the arrows must point in opposition to each other.

For a member with its arrows pointing towards its own midpoint that member is in tension; when they point towards the ends of the members then it is in compression. Therefore, in the load diagram:

Member	*Stress*
B-H	tension
H-O	tension
O-I	compression
I-D	tension
I-F	compression

Correction

In the symmetrical structure, "Stress Calculations for Pole Line Structures—III" (Electrical World, July 8, 1944, page 106) errors were made in composition.

Incorrect Formula	Corrected Formula
$c = \frac{\left(\frac{P}{2h}\right)/h_2}{\sin\theta}$	$\frac{\left(\frac{P}{2}h\right)/h_2}{\sin\theta}$
$t = \frac{\left(\frac{P}{2h}\right)/h_2}{\sin\theta_1}$	$\frac{\left(\frac{P}{2}h\right)/h_2}{\sin\theta_1}$

Also the statement was made that "there is no stress in member T of Fig. 3 (b) for loads as shown. T_1 is the proper member designation.

THERMAL RESISTANCE OF INSULATION SINGLE-CONDUCTOR CABLE*

By L. G. McDOWELL.†

The thermal resistance of the insulation of single-conductor cable may be obtained very easily from the accompanying chart. As $R_1 = \frac{0.00522\ \rho\ G}{n}$, where n=1 and $G = \log_e \frac{d_2}{d_1}$ for single-conductor cable, the thermal resistance may be written:

$$R_1 = 0.012\ \rho \log_{10} \frac{d_2}{d_1}$$

where R_1=Thermal resistance of insulation, in degrees C/watt/foot of cable

ρ=Thermal resistivity of insulation, in deg. C/watt/cm²

d_2=Outer diameter of insulation (core diameter)

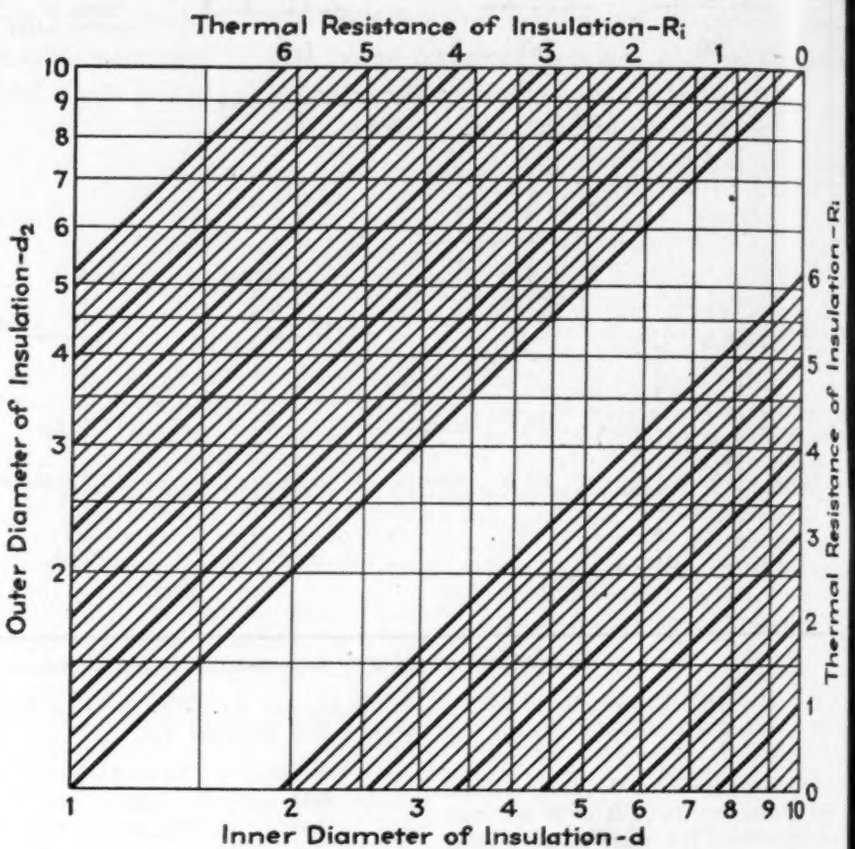
d_1=Inner diagram of insulation (conductor diameter) d_1 and d_2 are in the same units.

The chart is drawn for a value of ρ=700 which is the value recommended by the I.P.C.E.A. and E.E.I. for paper insulation. Recommended values for other insulation and the corresponding correction factors are as follows:

Material	ρ	*Multiply value from chart by*
Varnished Cambric	600	0.857
Rubber	500	0.715
Other	ρ	ρ/700

No units have been indicated for d_2 and d_1 on the chart as they appear as a ratio in the formula for R_1 and it is necessary only that they be expressed in the same units. By multiplying the indicated scales by suitable constants, the scales may be expressed in any desired unit. When the constants for both scales have the same value, the value of R_1 will be found in the upper left portion of the chart. When the constant for the d_2 scale is 10 times the constant for the d_1 scale, the value of R_1 will be found in the lower right portion of the chart.

Example (1): For single-conductor 350,000-cir. mil, VC-insulated cable with 141 mils of insulation: conductor diameter=d_1=0.681 in. (concentric stranding) and core diameters=d_2=0.963 in. To express the scales in inches at these magnitudes, multiply both d_1 and d_2 scales by 0.1. Then the value of R_1 is determined in the upper left portion of the chart to be 1.27 which multiplied by 9.857 gives 1.09 as the value of R_1 for this cable.


Thermal Resistance of Insulation-Ri
6 5 4 3 2 1 0
10 9 8 7 6 5 4 3 2
Outer Diameter of Insulation-d2
1 2 3 4 5 6 7 8 9 10
Inner Diameter of Insulation-d
Thermal Resistance of Insulation-Ri
0 1 2 3 4 5 6

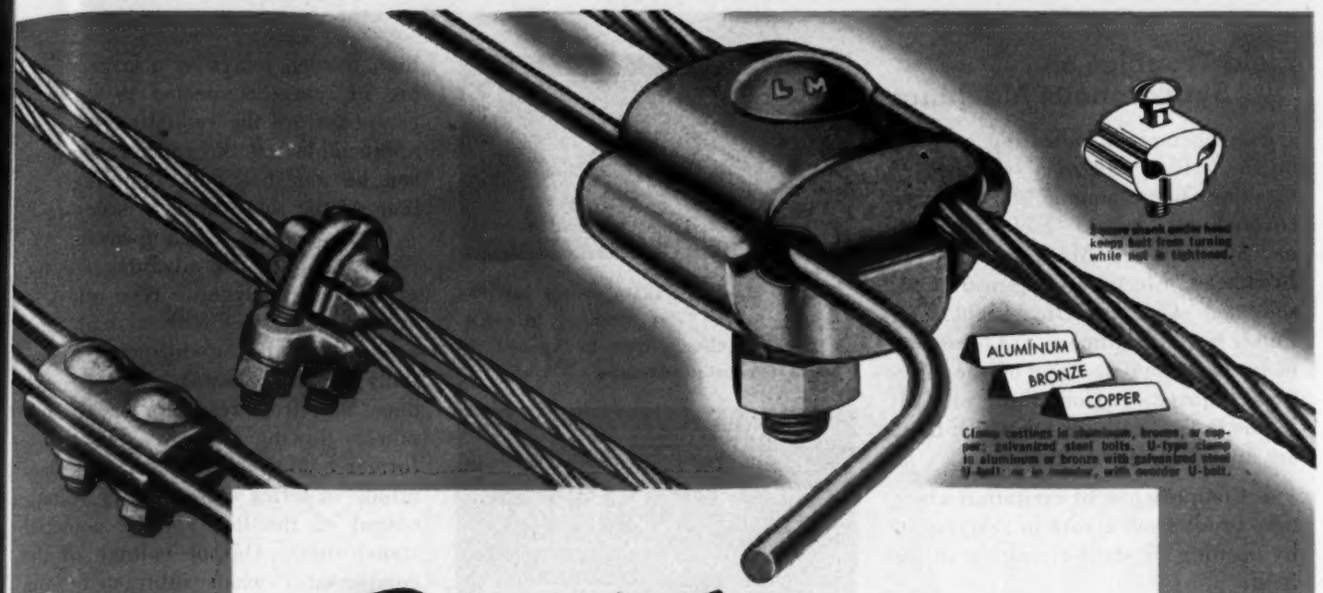
Thermal resistance of paper insulation of single-conductor cable

Example (2): For single-conductor 500,000-cir. mil, VC-insulated cable with 141 mils of insulation: conductor diameter=d_1=0.814 in. (concentric stranding) and core diameter=d_2=1.096 in. To express the scales in inches at these magnitudes, multiply the d_1 scale by 0.1 and the d_2 scale by 1.0. Then the value of R_1 is determined in the lower right portion of the chart to be 1.09 which multiplied by 0.857 gives 0.94 as the value of R_1 for this cable.

This chart may also be used for obtaining the thermal resistance of any material in cylindrical form (such as fiber or transite duct, duck tape covering over lead sheathed cable, etc.) where the heat transfer is uniform. When used in this way d_2=outer diameter of cylinder and d_1=inner diameter of cylinder and the values of R_1 obtained from the chart must be multiplied by the ratio of the thermal resistivity of the material (in degrees C watt per cm²) to 700.

*See also issues of Electrical World, June 24, 1944, page 104, July 22, 1944, page 140, and August 19, 1944, page 122.

†Assistant Engineer, Consolidated Edison Company of New York, Inc.



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Field Troubles on Synchronous Machines

Six schemes of indicating grounds on the field circuit of a synchronous machine were among the subjects covered in a paper "Field Troubles on Synchronous Machines" by L. Brickhead, Electrical Engineer, Consolidated Gas Electric Light and Power Co. of Baltimore and presented before a recent meeting of the Electrical Equipment Committee of EEI.

The type of failures for which these are applicable are:

1. Complete loss of excitation which may result from errors in relaying or by opening or short circuiting of the field.
2. Partial loss of field caused by faulty operation of the voltage regulating equipment, by operating errors or by accidental insertion of resistance through mechanical trouble.
3. Partial short circuit involving internal shorts or double grounds in the field circuit.

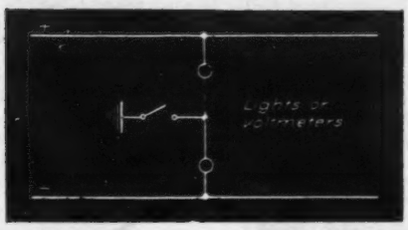

FIG. 1—Ground near midpoint is not indicated. In event of ground, circuit must be opened to prevent bearing damage by use of this scheme

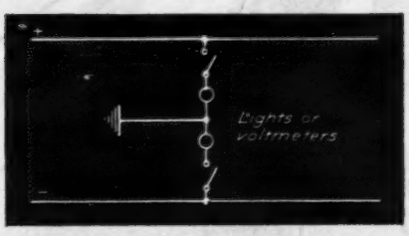

FIG. 2—Close one switch at a time for complete coverage. In event of ground, circuit must be opened to prevent bearing damage as in Fig. 1

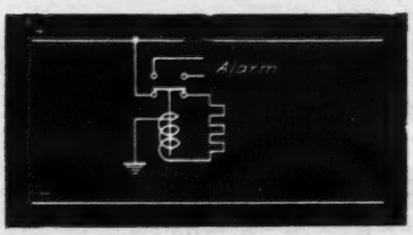

FIG. 3—Provides full coverage if main field rheostat is used or if transferable to either polarity. Voltmeter and switch can replace relay

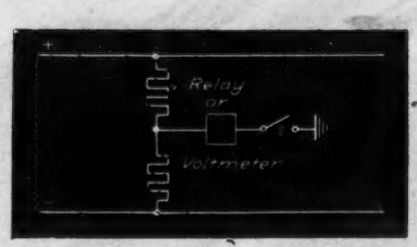

FIG. 4—Can be made sensitive enough to cover 99 + % of winding. In event of ground, circuit must be opened to prevent bearing damage

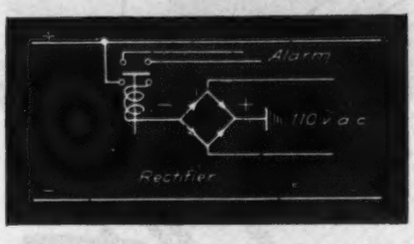

FIG. 5—Complete coverage. Brush from shaft to ground necessary to prevent bearing damage. Voltmeter can replace relay in this scheme

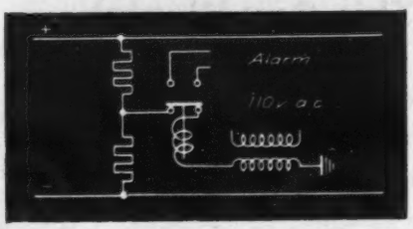

FIG. 6—Complete coverage. Voltmeter and switch can replace relay

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Compensators For Distance Relaying—III

By J. L. BLACKBURN *
Relay Engineer, Westinghouse Electric & Manufacturing Co., Newark, N. J.

In this third concluding article of a series, additional points are given on application of the compensator.

The compensator is not intended to be used as an equivalent substitute for high voltage potential transformers or devices. The secondary winding of the compensators is connected in series with the low voltage potential transformers and relay coils so that the voltage across the relay coils is less than the potential transformer secondary voltage at zero compensation. With a fixed relay burden, this compensator impedance drop is always a constant percentage of the total voltage. With one or two sets of distance relays of low burden this reduction in voltage is negligible. With high burden relays or a larger number of relays connected to a set of compensators the reduction becomes appreciable but the relay calibration can be modified correspondingly as long as the relay burden is constant.

In this manner the compensator can provide economical advantages in the application of distance type relays to high voltage lines without high voltage potential transformers. Essentially the compensator is set to reproduce the drop resulting from fault power flowing through the transformer bank in both phase and magnitude in terms of secondary voltage output of the low voltage potential transformer. Output voltage of the compensator when subtracted from the output of the low voltage P.T. is equivalent to the high voltage potential required for the distance relays.

* Previous articles in ELECTRICAL WORLD, issues of July 22, page 146, and Aug. 19, page 112.

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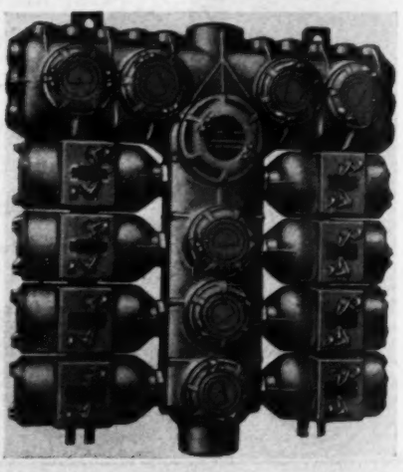
Explosion-Proof Panelboard for Hazardous Area

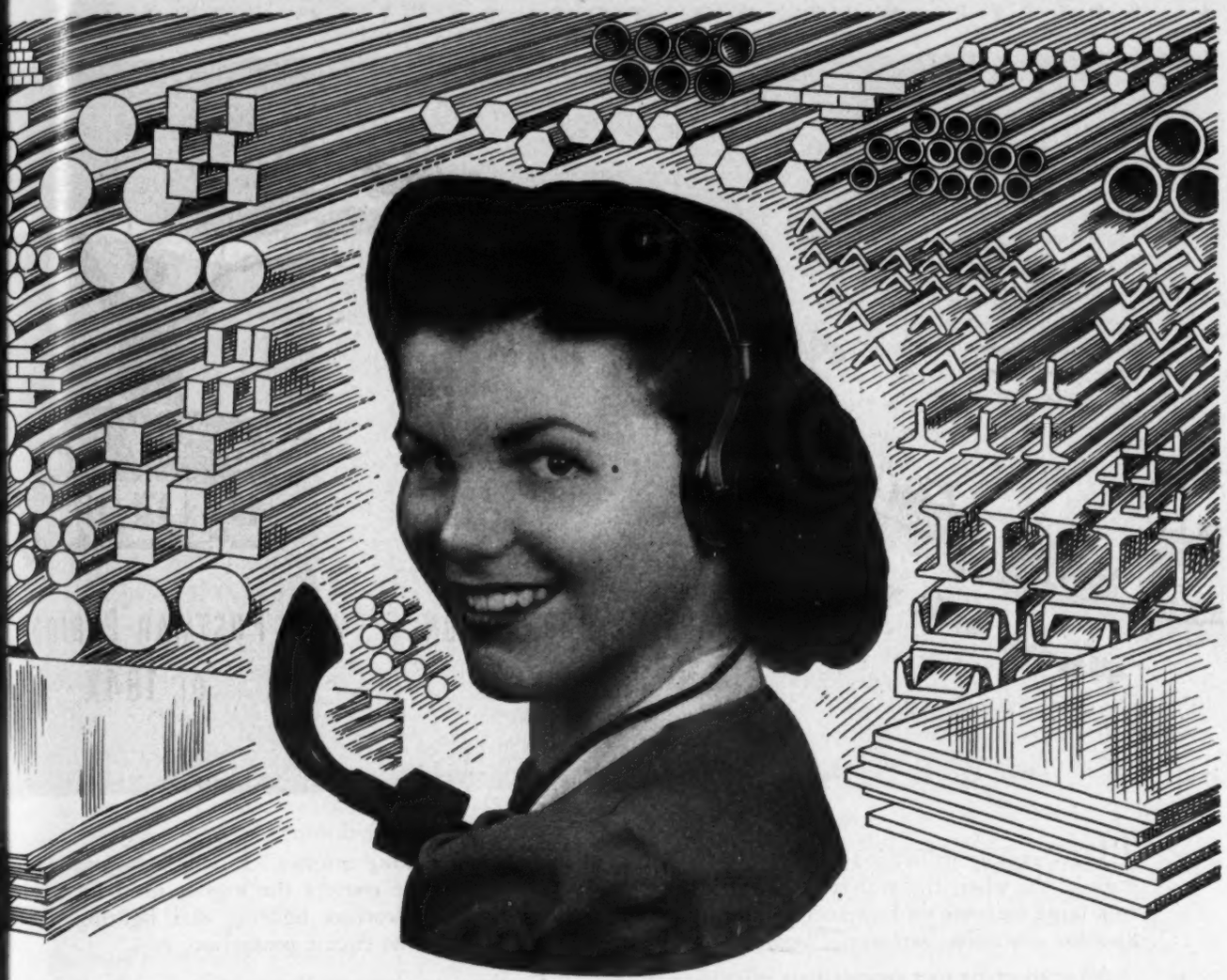
In locations, hazardous because the atmospheres may be laden with flammable gases or vapor, special precautions must be employed if accidental explosions are to be prevented. These precautions include adequate ventilation, humidity control, use of non-sparking tools and appliances,



Showing construction of explosion-proof panelboard

special shoes and garments, and other safeguards. The requirements for electrical installations equipment and apparatus are laid down in Article 500 of the National Electrical Code.

The fundamental requirement for the electrical system is that all wiring, equipment, and apparatus be enclosed



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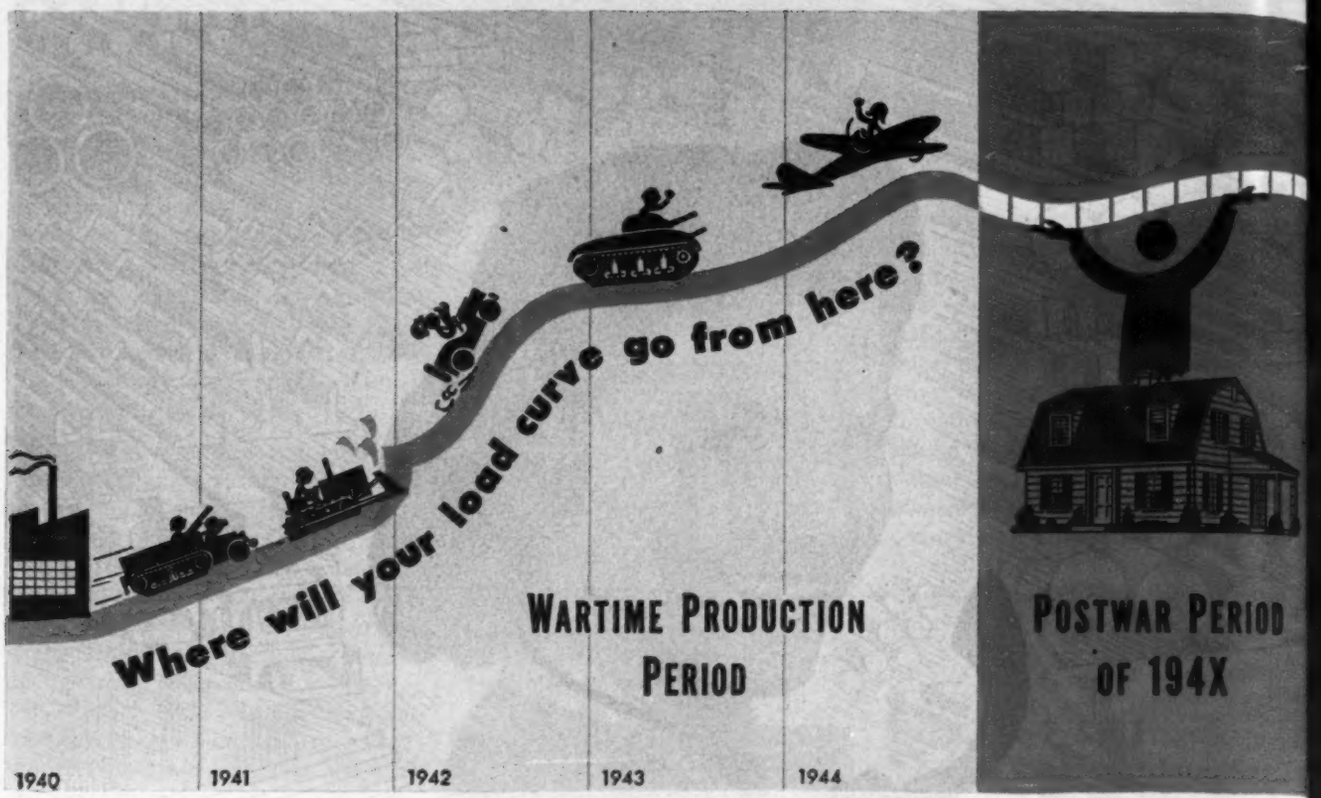

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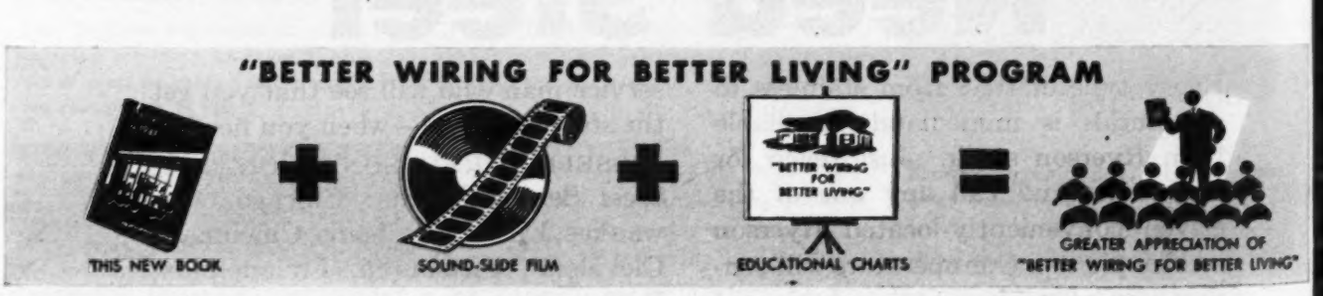
This load building program is built around the new book..."Electrical Living in 194X"... designed for the building profession and allied interests, *including utilities.* It will help you explain to home owners the urgent need for proper wiring—correct lighting and lighting controls—modern circuit protection, etc.

Further—to promote this program, we have prepared a *sound-slide film* and *chart* especially for utilities. Your representatives can use this material in selling the need of "wiring ahead" . . . to local architects, engineers, builders, contractors, wiremen and other factors in the building industry.

For complete information regarding the "Better Wiring for Better Living" Program, communicate with your Westinghouse District Office or write: Better Homes Department (EW-94), Westinghouse Electric & Manufacturing Company, Pittsburgh 30, Pennsylvania.


"BETTER WIRING FOR BETTER LIVING" PROGRAM
THIS NEW BOOK
SOUND-SLIDE FILM
"BETTER WIRING FOR BETTER LIVING"
EDUCATIONAL CHARTS
GREATER APPRECIATION OF "BETTER WIRING FOR BETTER LIVING"

Westinghouse

Plants in 25 Cities *Offices Everywhere*

TUNE IN: John Charles Thomas, *Sunday 2:30, EWT, NBC.* Ted Malone, *Monday, Wednesday, Friday 10:15 pm, EWT, Blue Network*

what are termed "explosion-proof" housings such as recently developed by the Crouse-Hinds Company of Syracuse, N. Y.

An explosion-proof housing is not to be intended to keep the flammable atmosphere from entering, but rather, is one intended to keep an internal explosion from igniting the surrounding atmosphere. In other words, the explosion must be confined to such an enclosure.

Such an enclosure must not only be strong enough to withstand the explosion, but also the joints must be tight enough to prevent escape of dangerously hot gases, flames, or sparks. It is quite obvious that conventional enclosures suitable for non-hazardous locations are entirely unsuitable for locations where explosive atmospheres exist. Also, it is obvious that conditions imposed will result in designs differing radically from those usually encountered.

The illustration of an explosion-proof panelboard discloses no similarity to the usual steel cabinet enclosed panelboard commonly found in ordinary locations.

Divided into Compartments

In the explosion-proof structure, cylindrical shapes have been employed wherever possible to obtain adequate strength with minimum weight. Furthermore, the structure is divided into compartments, thereby reducing the volume of exploding gases and minimizing the pressures developed.

The cylindrical compartments located at each side of the central T-shaped compartment contain externally operable thermal actuated circuit breakers which protect the branch circuit wiring. The central compartment houses terminal blocks for the main and branch circuit conductors. To facilitate handling the relatively stiff main conductors, extra large hand holes are provided. Terminal blocks for branch circuits also are accessible through hand holes. All hand holes are closed by threaded covers.

The main conduits can enter at either the top or bottom of the T compartment. The branch conduits leave at the top of this compartment.

The construction employed utilities threaded joints only and all flat joints have been avoided.

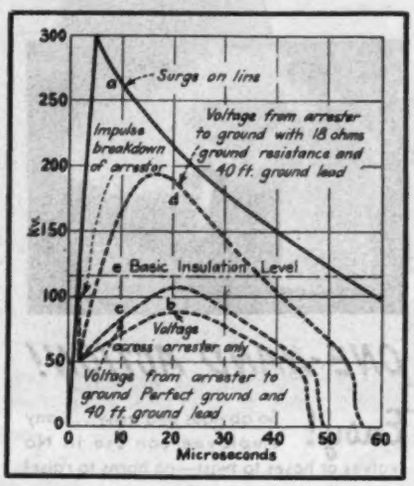
Limiting Lightning Surge at Cable Terminals

By RICHARD C. WALDRON

Assistant to Chief Engineer
The Okonite Co., Passaic, N. J.

Lightning surge peaks arriving at a cable terminal must be limited so that after entering the cable and being reflected the maximum will not exceed the safe value. The wave after passing an arrester will usually be a relatively flat top wave which builds up higher voltages when reflected than a peaked wave of the same maximum potential.

The arrester should be connected so that the voltage across the cable is limited to the voltage drop across the arrester. This can only be accomplished by bonding the lightning arrester ground with the cable sheath, shielding, armor or other grounds. This bond should connect directly to the arrester with a short straight lead rather than being bonded to the arrester ground part way down the pole. The reason for this is readily seen by examining the accompanying illustration which shows the voltage across a typical arrester during a surge discharge. The wave in this case was a 5-40 microsecond wave having a 300 kv. peak resulting in a 5,000-amp. maximum current. A 5-microsecond front is rather long, but is used to clarify the drawing. The steepness of the wave front does not appreciably affect the maximum voltages.



VOLTAGES across a typical arrester during a surge discharge

The voltage rises until it reaches the breakdown voltage of the arrester, in this case 100 kv. The voltage then drops to the IR voltage drop across the arrester and follows the lower curve (b), its shape depending on the characteristics of the arrester and the shape of the surge. Curve (c) is the voltage drop including the impedance drop in the lead down the pole. A large part of the lead drop is due to the reactance of the lead so it should be kept as straight as possible to keep this at minimum value.

Total Drop Shown

Curve (d) shows the total voltage drop with a driven ground rod having an 18-ohm resistance to ground. If the cable sheath is grounded separately, this voltage will be the voltage of the surge arriving at the cable terminal.

Curve (e) represents the basic insulation level of the circuit. It is seen that with good grounds for the lightning arresters the voltage during a surge will not reach this level. However, if the arrester ground has a high resistance, safe voltages may be exceeded. The impulse strength of the cable is usually well above this insulation lvel, but with very high ground resistance excessive voltages may be obtained. Cable terminals will also be subjected to this voltage and pothead flashover may result from high resistance grounds as has been explained.

The effect of these high resistance grounds will be overcome if the cable sheath is also connected to the arrester ground in which case the voltage across the cable will be limited to curve (b). If the connection is made to the lead from the arrester the voltage will be somewhere between (b) and (c) depending on the length of lead between the arrester and the point of bonding.

Current Follows Sheath

With this bonding some of the discharge current will follow the cable bond to the cable sheath and then to the ground. This adds a small voltage across the cable terminal depending on the impedance of the cable sheath connection to the arrester and the relative impedances of the parallel grounds. For this reason, the arrester ground should have as low a resistance as practical even with cross bonding.

KILL FIRE this easy way

Randolph "4"

CARBON DIOXIDE
FIRE EXTINGUISHER

Few people <u>think</u> about fighting a fire until they actually face one. That's why it's important that every fire extinguisher operates *easily—quickly—thoroughly!*

Randolph "4" simplifies, speeds fire-fighting. This modern extinguisher with the "breath of ice" chokes gasoline, oil, paint, machine, electric fires—instantly. Hits the blaze <u>before</u> damage is done!

Approved by Underwriters' Laboratories, Inc.

Mobilize against fire with Randolph carbon dioxide protection. For complete details and prompt service, call your supply house, or write us—today.

ONE-HAND ACTION!

Easy! So obvious and easy . . . any employee can use it. No valves or hoses to twist—no horns to raise!

Fast! Touch the trigger . . . and powerful carbon dioxide charges into the flames . . . smothers the fire in a penetrating, snowy blanket!

Safe! Does not damage equipment or conduct electricity.

Neat! Randolph carbon dioxide is dry and odorless. Actually disappears after the fire is out. Leaves no foam or liquids to clean up.

Efficient! Carbon dioxide will not deteriorate. Remains effective in extreme temperatures.

SEND NOW *for free booklet "Sharpshooting at Flames." Illustrates latest techniques in carbon dioxide fire fighting.* NAME_____

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RANDOLPH LABORATORIES *INC.*

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Fire Hazards and Their Elimination

Protection of electrical utility service and property and of life against fire is accomplished through elimination of potential fire hazards. This method will be discussed from the standpoint of electrical equipment.

Electric wiring is the first subject to be considered; this treatment will be under five headings.

A. Compliance with Standards—All electric wiring should be installed in conformity with company standards, or with National Electrical Code Standard of National Board of Fire Underwriters.

Check After Alterations

Periodical check should be made by plant superintendents and foremen to see that no installation of electric wiring exists in any building, which is in violation of these standards. Such check invariably should be made after any alterations in electric wiring or electric equipment.

B. Fuses—Fuses should be of such rating as to provide adequate protection and at the same time to carry normal load. Under no circumstances should the rated capacity of fuses exceed the allowable current-carrying capacity of wires in the circuit.

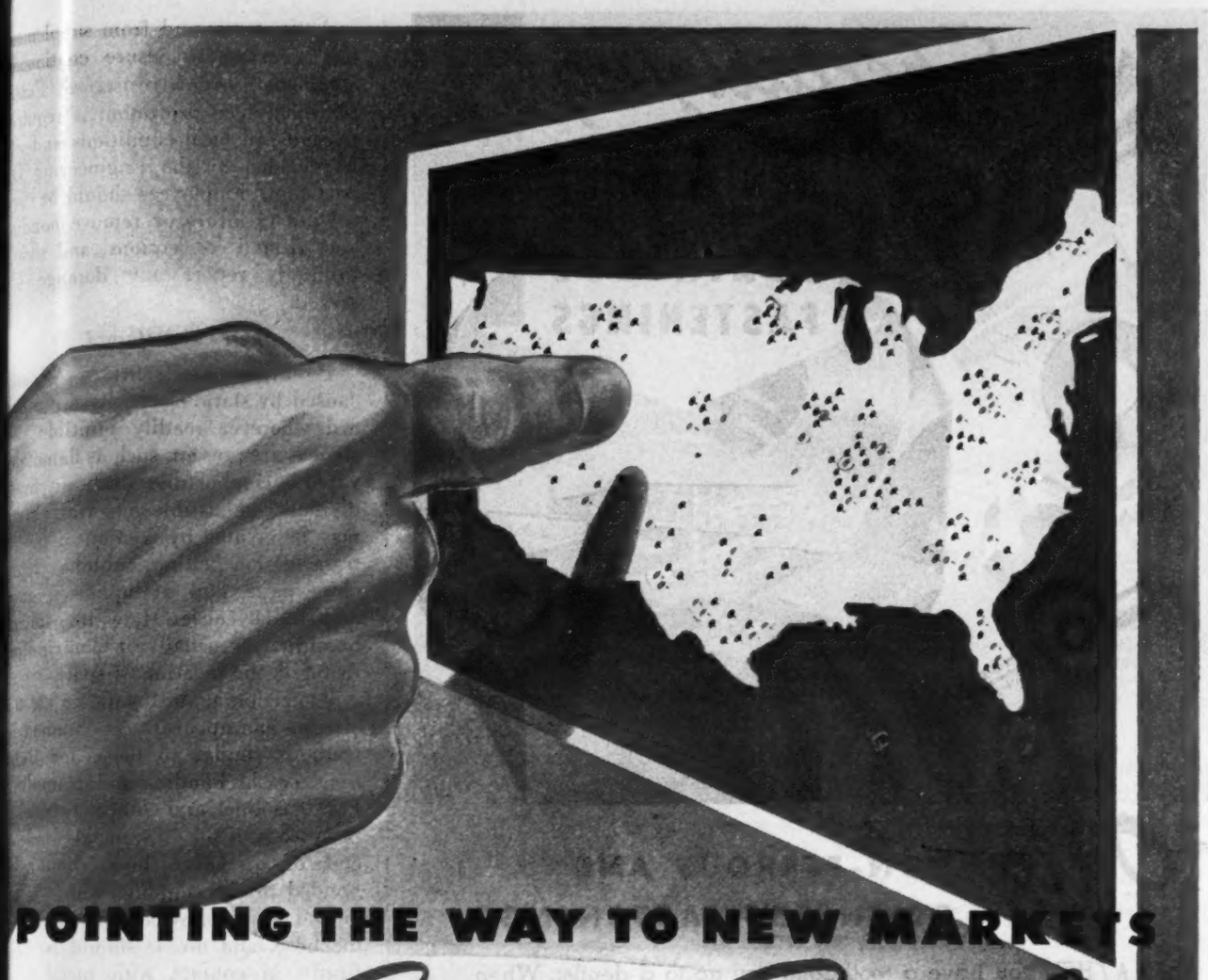
Bridging of fuses or substitution of copper wire, or similar makeshift in place of fuses, is not to be resorted to under any circumstances. Spare fuses of correct sizes should be kept on hand hand in a convenient location for use as required.

Check Ground Condition

C. Grounding—All electrical apparatus and circuits should be effectively grounded, in conformity with company rules or National Electrical Code. Periodical check should be made as to mechanical condition and electrical adequacy of ground connections and of the buried metallic structure to which ground leads are attached. Dependable grounding is essential to safety of persons and of property; faulty or improper grounds give a false sense of security.

D. Lightning Hazards—Chief protection against lightning is obtained from proper grounding of circuits

* Second in a series of seven articles which began in Electrical World Sept. 2, 1944, page 100; adapted from "Handbook of Fire-Safety Practices for Public Utility Property," Edison Services Inc., New York, N. Y.



POINTING THE WAY TO NEW MARKETS THROUGH *Mosinee Paperology*

Many materials born of war necessity have "made good" to an extent far beyond expectations. New product advantages create broader markets. Alert manufacturers are appraising the progress of paper in its adaptability to many products.

That is where Mosinee Paperology comes in, to point the way to new markets by improving products, reducing costs, expanding production . . . by engineering the proper properties and characteristics into paper to meet definite specifications in terms of the product and production processes. For instance, wet strength, controlled absorbency, definite relationship between cross-direction tensile and machine-direction tensile, accurate caliper, maximum uniform strength, uniform weight for maximum yardage, or other essential characteristics can be engineered into paper by Mosinee Paperologists. Mosinee is ready now to help you "make the most of paper" in seeking new markets.

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MOSINEE • WISCONSIN
Essential Paper Makers

Please address your letter "Attention Dept. B"

Only NON-FERROUS AND STAINLESS FASTENINGS

WHEN you have a toothache you go to a dentist. When you need legal advice you go to a lawyer. Both men are specialists.

By the same token . . . when you need non-ferrous and stainless fastenings come to the house that specializes on them . . . Come to the Harper Organization which is concerned exclusively with the manufacture of bolts, nuts, screws, washers, rivets and specials of Brass, Copper, Naval Bronze, Silicon Bronze, Monel and Stainless . . . an organization not concerned with common steel.

This specialization brings refinements in product quality and "extras" in service to customers that are most rare. Start these "extras" your way by writing on your company letterhead for a complimentary copy of a 4 color, 104 page catalog and reference book.

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and structures, and from su[pple]mentary bonding to insure co[ntinu]ous escape-path of low resistance. Ex[tent] to which such protection is requi[red] depends on local conditions and [will] be decided by the Engineering [De]partment. Employees should be ca[re]ful not to injure or remove bond[s] and ground connections, and sho[uld] promptly report any damage [ob]served.

Sparks Are Hazard

E. Static Electricity — Spa[rks] caused by static electricity are a ha[z]ard wherever readily ignitible s[ub]stances are present, such as flamma[ble] vapors, combustible dust, or fin[ely] divided combustible material. Sta[tic] may be created by friction of pow[er] transmission belting, rubbing of ma[-]chine parts, flow of liquids or ga[ses] and similar causes. Low atmospher[ic] humidity is usually a contributi[ng] factor in the creation of sparks.

Protection against static on electr[ical] circuits and apparatus is obtained [by] methods similar to those for ligh[t]ning, i.e., by bonding and groundin[g]. For gasoline and other petroleu[m] products and solvents, metal nozzle [at] end of discharge hose should [be] bonded to the coupling which is a[t]tached to pump, by copper wire insi[de] the hose, and nozzle should be he[ld] firmly in contact with metal tan[k] which is being filled with gasoline. A[ll] metal receptacles, funnels, etc. f[or] gasoline and similar fluids should [be] kept in contact with each other, [or] bonded together by conductors, an[d] preferably grounded.

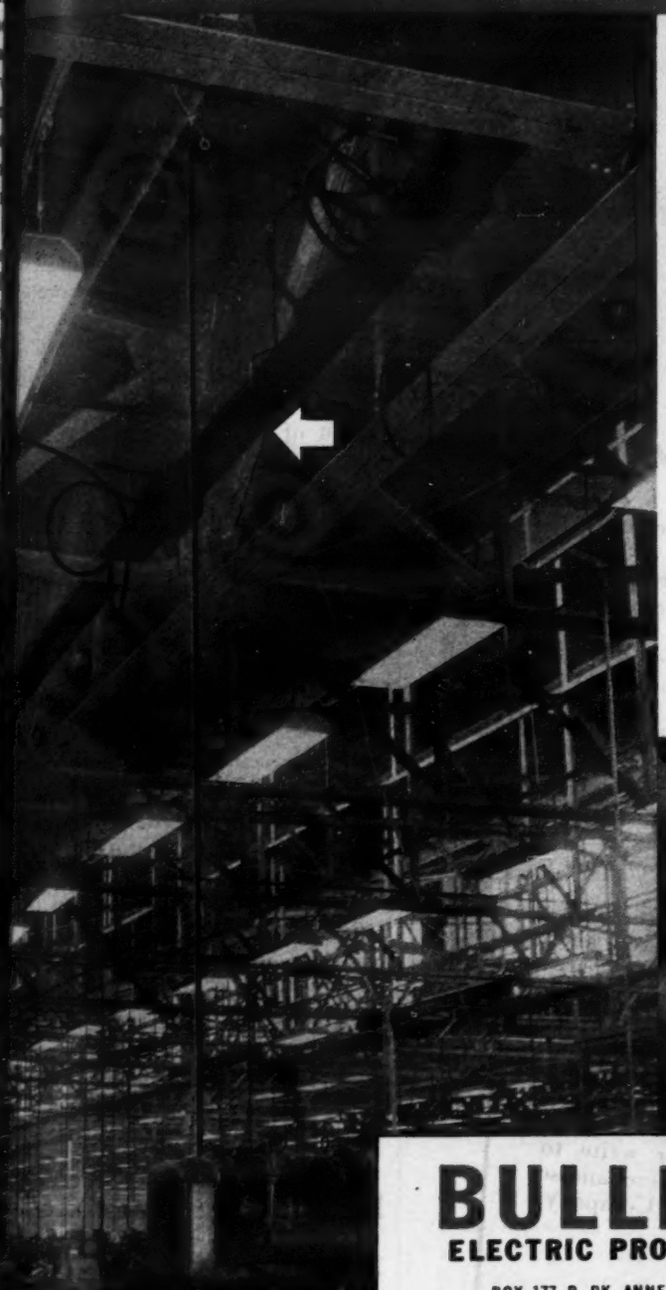
•

Electronic Sorting of Tiny Contact[s]

Greater speed in the sorting and in[-]spection of tiny contact assemblie[s] produced at General Electric's Sch[e]nectady Works has been made pos[-]sible through the development of a[n] electronic sorting table which route[s] the assemblies into three differen[t] channels depending on whether the[y] are too high, too low, or within th[e] tolerances.

Previously, the contact assemblies, each small enough to require handling with tweezers, were sorted and in[-]spected by hand. Each assembly was checked with a needle micrometer to determine whether it was within the prescribed tolerances.

... BACK TO PEACETIME PRODUCTS



BULLDOG WILL SPEED RECONVERSION

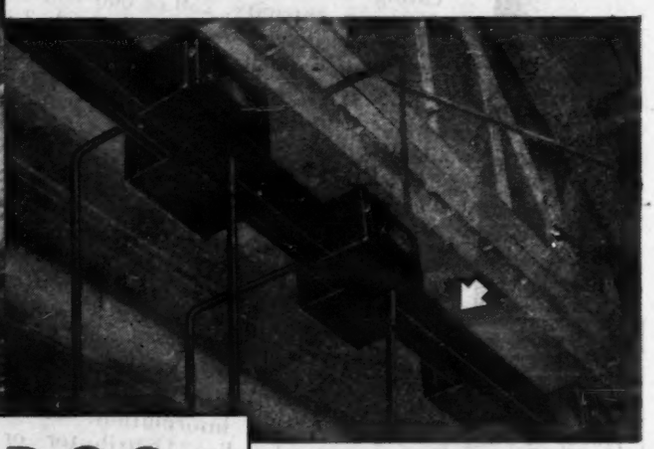
In the great war conversion race, BullDog Electrical Distribution Systems have cut weeks — even months — from change-over schedules. Maintenance time and cost were slashed. Output was stepped up, safety improved.

The reason? BullDog Bus Duct systems make plug-in power for machines immediately available for any shop set-up—furnish mobile power for portable tools, cranes and hoists — provide completely flexible lighting.

Looking ahead, BullDog-equipped plants can also count on speedier, easier reconversion to peace production.

Now is the time to plan for the *reconversion* race. We offer the help of expert BullDog engineers, and will gladly send complete literature.

There's a Big Job Ahead — Buy More War Bonds



BullDog BUStribution DUCT provides complete flexibility on branch power circuits. The plug-in feature enables you to change production machines at will — rearrange whole departments without interrupting production elsewhere.

BULLDOG
ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ont.

Field Engineering Offices in All Principal Cities

ALSO MANUFACTURERS OF
CU-BREAK SAFETY SWITCHES • SWITCH-
ARDS • SAFTOFUSE PANEL BOARDS •
CUIT MASTER BREAKERS • UNIVERSAL
OL-E-DUCT • INDUSTRIAL TROL-E-DUCT.

PROTECT ALL CIRCUITS WITH G-E FUSES

WHETHER you need enclosed cartridge fuses with 600 ampere capacity or 15 ampere plug fuses, you'll find them all in the G-E line. Many kinds and sizes are available. The G-E line includes:

1. *Non-renewable enclosed fuses*, either indicating or non-indicating with 1 amp. to 600 amp. capacity, 250 or 600 volts.
2. *Renewable enclosed fuses* with 3 amp. to 600 amp. capacity, 250 or 600 volts.
3. *Silvend fuses* with silver-plated contacts with 3 amp. to 600 amp. capacity, 250 or 600 volts.
4. *Pyrex* plug fuses* with 3 amp to 30 amp. capacity, 125 volts.

All of these fuses are made of the best materials. They are thoroughly tested and accurately rated. The Silvend fuses are designed for use with apparatus having silver-plated fuse contacts. Heating due to oxidation does not occur with this combination. The Pyrex fuses have magnifying windows for easy reading.

For further information, see the nearest G-E Merchandise Distributor or write to Section D942-9, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

*Reg. U.S. Pat. Off.

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M., EWT, NBC. "The World Today" news every weekday 6:45 P.M., EWT, CBS.

BUY WAR BONDS AND KEEP THEM

GENERAL ELECTRIC

The specially designed sorting ta incorporates the recently announc new electronic relay and a factor constructed "contact head." Each sembly is fed onto a 45-degree sli which is part of the contact hea About halfway down the slide, the sembly comes to a contact point cated at a preset height. If the asse

ELECTRONIC sorting table for speeding up the sorting and inspection of tiny contact assemblies. Chutes for large and correct size assemblies shown at lower left

bly touches the point, it is oversize and the contact made closes the gri circuit of the electronic relay's elec tronic tube, which energizes an elec tromagnetic relay, another part of th electronic relay. A solenoid is next en ergized, dropping the assembly dow a chute into a container for oversiz parts.

Acceptables Segregated

A short distance beyond the firs point a second contact point is set standard height less tolerance. Sinc oversize assemblies have already bee eliminated at the first contact point parts touching the second point ar within acceptable limits and ar "shot" down another chute.

Undersize assemblies do not touc either point and slide undisturbed t a third tray. The principles involve in this application may be applied t the inspection and sorting of othe small parts. The application must however, be worked out carefully fo the particular part to be inspected.

•

Farm Relief: Electrification

A survey of 215 farms in New York state revealed that an average of at least 40 days of labor per farm per year could be saved by electrification. In 267 homes of the state the saving was 26 days per year.

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ADDR

ELECTRIC

ARE YOU WELDING STAINLESS STEEL? HERE'S *New Light* ON THE SUBJECT

This book can save you time and void spoilage of vital alloys, both more than ever essential to the war program today. Describes and illustrates equipment, procedures, precautions. Request copies on your company letterhead, please.

ADDRESS DEPT. EW-24

SUCCESSFUL stainless steel welding, as many a shop has found out the hard way, puts a premium not only on knowing what to do, but also what to avoid doing—and why.

That is because the problem, first of all, is a double one as compared to ordinary carbon steel welding, since it calls for maintaining the corrosion resistance of the parent metal across the weld area, as well as its strength. Furthermore, although stainless steel welds easily, the various members of the stainless family differ considerably from carbon steel—and even from each other—in the physical and chemical phenomena they exhibit during the welding process.

Information, clear and complete, is the basic answer. We've supplied it in a new 64-page, full-color booklet, *"Welding Stainless Steels,"* covering all the commonly-used hand or machine methods of welding Allegheny Metal. Employing a new idea in graphic illustration, this book is, we believe, the most complete and understandable coverage of the subject yet published—a welding shop "bible" purposely made so clear and simple that it is also ideal for student training. ● *Write for your copy (see at left).*

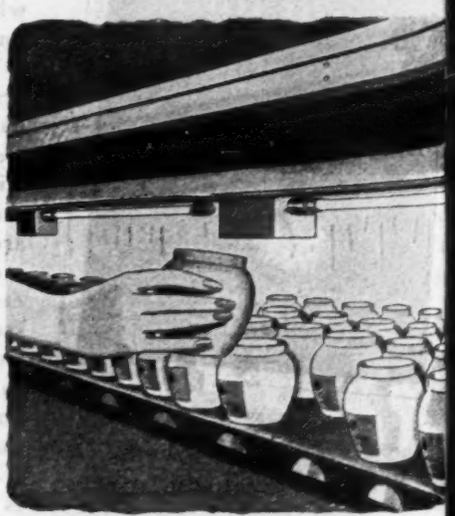
Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

Branch Offices in Principal Cities . . . Allegheny Metal also handled by all Joseph T. Ryerson & Sons, Inc. Warehouses

A-9078 . . . W&D

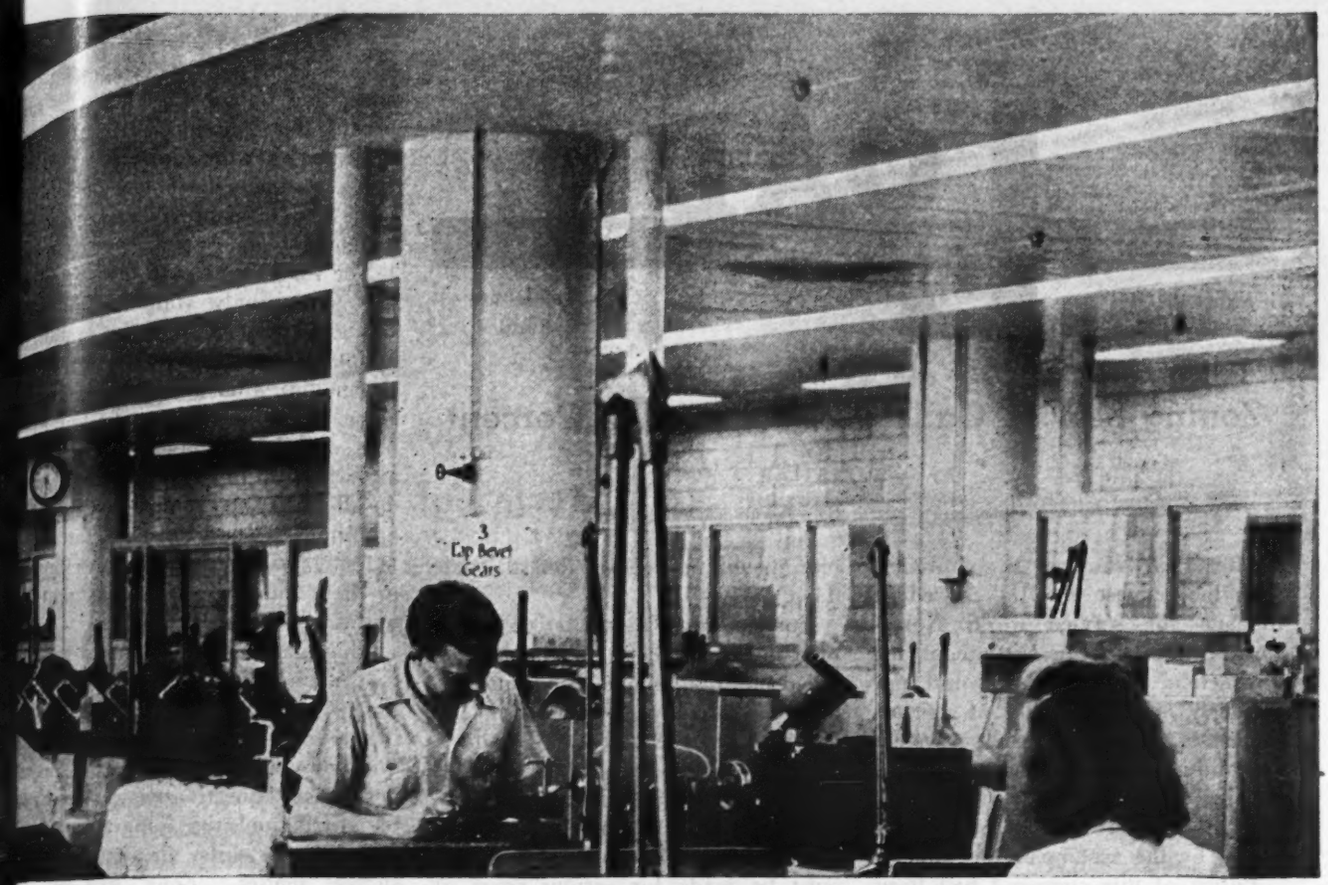
AVENUES OF LIGHT FOR WORKING EYES

TOMORROW, lamps and light will serve America in new ways, new forms, new places. Westinghouse Mazda Lamps in new shapes and colors, along with new techniques in lighting, will open up a whole new field of decoration and display for the store owner. And Westinghouse Sterilamps—already widely applied by laboratories and food and drug manufacturers to reduce contamination from air-borne bacteria — will be used in homes, schools and public buildings to lessen the risk of infection and help bring safer, more healthful living.

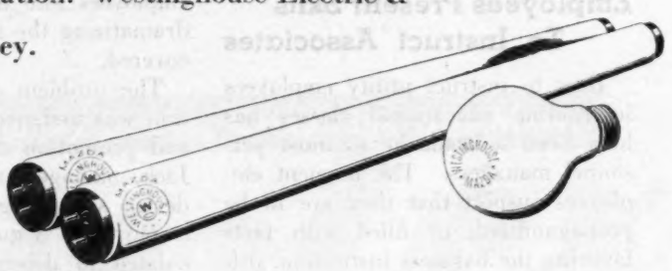


HELP SHORTEN THE WAR . . BUY MORE BONDS THAN BEFORE!

WESTINGHOUSE PRESENTS JOHN CHARLES THOMAS SUNDAY 2:30 EWT., N.B.C. ★ TED MALONE • MONDAY, WEDNESDAY, FRIDAY 10:15 EWT., BLUE NETWORK



New lighting techniques developed by Westinghouse engineers, using today's high-efficiency Westinghouse Mazda Lamps, are bringing See-ability benefits to American industry. With See-ability to guide them, working eyes can operate faster, more accurately. Precision work can be done by more people, with fewer errors and less fatigue — all important factors in the huge job of arming and supplying our fighting men. And when this big job is done, today's higher lighting standards will bring See-ability benefits to peacetime factories, offices, stores and homes. Give your customers the benefit of Westinghouse research and progress in lighting, recommend bright, long-lasting Westinghouse Mazda Lamps for every lighting plan and installation. Westinghouse Electric & Manufacturing Co., Bloomfield, New Jersey.



Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

MAZDA LAMPS FOR SEE-ABILITY

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Zoning Service Calls Cuts Mileage 24 Percent

By L. H. KISTLER
Supt. Meter & Service Dept.
Northwestern Electric Co., Portland, Ore.

After Pearl Harbor, in compliance with the request of ODT to reduce mileage for service work, Northwestern Electric Co. cast about for a practical method that would not seriously hamper quality of its customer service. As a result a system of zoning service calls was adopted that has reduced average mileage per call by 24 percent since 1941, as shown by the accompanying table.

Policy of this company had been to cover the entire area of the city of Portland each day to repair electric ranges, handle "lights out" and "power off" calls. About two years ago the plan of dividing the city into zones was devised and the work was scheduled so that extreme ends of the city would be covered on alternate days.

Year	Mileage	Calls	Average Mileage
1941	78,570	26,436	3.7
1942	59,983	24,082	3.1
1943	52,644	18,659	2.8
1944 (4 mo.)	16,267	6,231	2.6

RESULTS of zoning service calls showing value to war effort

Portland with a population of approximately 400,000 is roughly divided into halves, one half being covered on Mondays, Wednesdays and Fridays, and the other on Tuesdays, Thursdays and Saturdays. Definite dividing lines were made and a conscientious effort is made to adhere to these divisions. Exceptions, of course, must be made for serious cases of trouble that cannot wait, but these are rather few in number. The heavily populated central district on both sides of the river that divides the city are covered daily.

In most cases the public has been willing to cooperate when the situation has been properly explained. Zoning has made it possible for the dispatcher to plan his work better and to eliminate unnecessary driving, thus resulting in saving of rubber, gas and equipment. It is felt that these savings have been of real value to the war effort.

• • •

Employees Present Skits To Instruct Associates

How to instruct utility employees in routine educational classes has long been a headache to most personnel managers. The moment employees suspect that they are to be propagandized, or filled with facts favoring the business institution, difficulties of human nature always arise.

To overcome this problem one company, Washington Water Power, Spokane, Wash., formulated their educational program by taking the employees into their confidence and dramatizing the subject matter to be covered.

The problem of employee education was assigned to the advertising and promotion department, Kimball Jack, manager, with instructions to devise something acceptable to the employees. A questionnaire was circulated to determine what subjects needed discussion. A long list of items came to light from this common-sense approach.

Employees checked off various phases of public relations, collection practices, history of the company, reasons for policies, wages, grievances and opportunity. It was surprising that a majority of employees indicated that their primary concern was company-customer relations while their own problems were given secondary importance.

The formula of each class meeting was surprisingly simple. Emphasis was given primarily to the matter of maintaining interest. The master of ceremonies, after a few words of welcome, spent approximately ten minutes discussing human nature such as, what do employees, and what do all people strive for—their ideals, ambitions, responsibilities, hates and fears. The company's contribution to these human desires was pointed out as incidental.

Thus gaining attention by talking to the employee about himself, prescribed subjects were handled according to importance as shown in the questionnaire. Replacing the previously used question-answer method of instruction, the department prepared short skits, dramatizing the subject matter. Four, five or six employees memorized and acted various parts. One playlet featured an employee in a tavern talking to typical customers, another at the bridge table, or a P.T.A. meeting, or in a town hall long before industry came into being. A wealth of talent and acting ability was found among employees, and several rehearsals throughout the day previous to performance were usually sufficient.

Question and Answer Period

A brief question and answer period came at the end of each class based on the subject matter of the skits. Interest was maintained by the lottery method of stating the question and then drawing a name from the hat for the answer. If the employee could not answer the question, his name card was put back for another chance drawing. If the answer was correct, a duplicate card was dropped in a box for the final drawing which was scheduled for the end of the series of classes and offered war bonds as prizes. Some classes reached 98 percent perfect answers.

Supplementing class instruction, brief paragraphs entitled "Know Your Company" were printed in the company house organ each month. Previous to the classes, scores of employees

SIMPLEX-TIREX

flexible electric cords and cables

with

Selenium Rubber Armor

for

Long Service
Economical Operation
Dependable Performance
All-round Satisfaction

Prewar Simplex-TIREX cords and cables were outstanding because of their tough, flexible outer covering or sheath, a selenium-cured rubber compound which was almost wearproof and earned the name "Selenium Rubber Armor" by the way it stood up under the use and abuse of hard service.

The protecting outer covering of TIREX cords and cables continues to be a "selenium rubber armor," fully deserving the name, although synthetic rubber has replaced natural rubber.

Extreme toughness and abrasion resistance can be obtained by curing natural rubber compounds with selenium. Similar results are being obtained with synthetic rubber. Selenium curing is used exclusively by us to produce cords and cables that you can depend upon for long, trouble-free performance.

When you buy cords and cables for portable electric tools or for mobile equipment that depend upon electric cables for power, you naturally want maximum value for the price you pay. You want long life and dependable, economical performance. You cannot do better than use Simplex-TIREX cords and cables with their "selenium cured, synthetic rubber armor."

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex WIRES and CABLES

SAFE... EFFICIENT AUXILIARY HEAT

HUNTER HEATERS for Trucks...Trailers

• Heating capacity and ability to withstand rugged conditions have been thoroughly tested in army tanks and trucks. Compact model illustrated has controllable heat range from 15,000 to 25,000 Btu/hr. Others with higher output for special requirement. Any good mechanic can install them. Easy to service.

HUNTER HEATERS for Busses . . . Personnel Carriers

• Same type and variety of units as described obove. Simplicity of installation and operation make them ideal either as auxiliaries for pre-heating or for efficient heating en transit, where electrical equipment of the carrier is adequate to supply small blower. Flame "Sealed in Steel", combustion exhaust outside of vehicle.

BULLETIN HG-4 Describes all types of Hunter Heaters

HUNTER AND COMPANY
Transport Equipment
1558 E. 17th St.
CLEVELAND • OHIO

were seen studying the pages of their house organ, so as to be properly prepared.

Classes usually lasted for one hour and were held on company time. The ideal class comprised seventy-five to a hundred employees, taken at random from all departments. It is a psychological fact that a large group will contribute most to morale.

The education classes have been surprisingly successful. Where employees once groaned at the mention of classes, now they ask: "What will you talk about next time?" "When do we meet again?" "Blank-blank sure made a swell old lady." "You know, last night I used the same arguments I heard in the meeting . . . worked pretty good, too."

•

Appliances Bought for Future Delivery

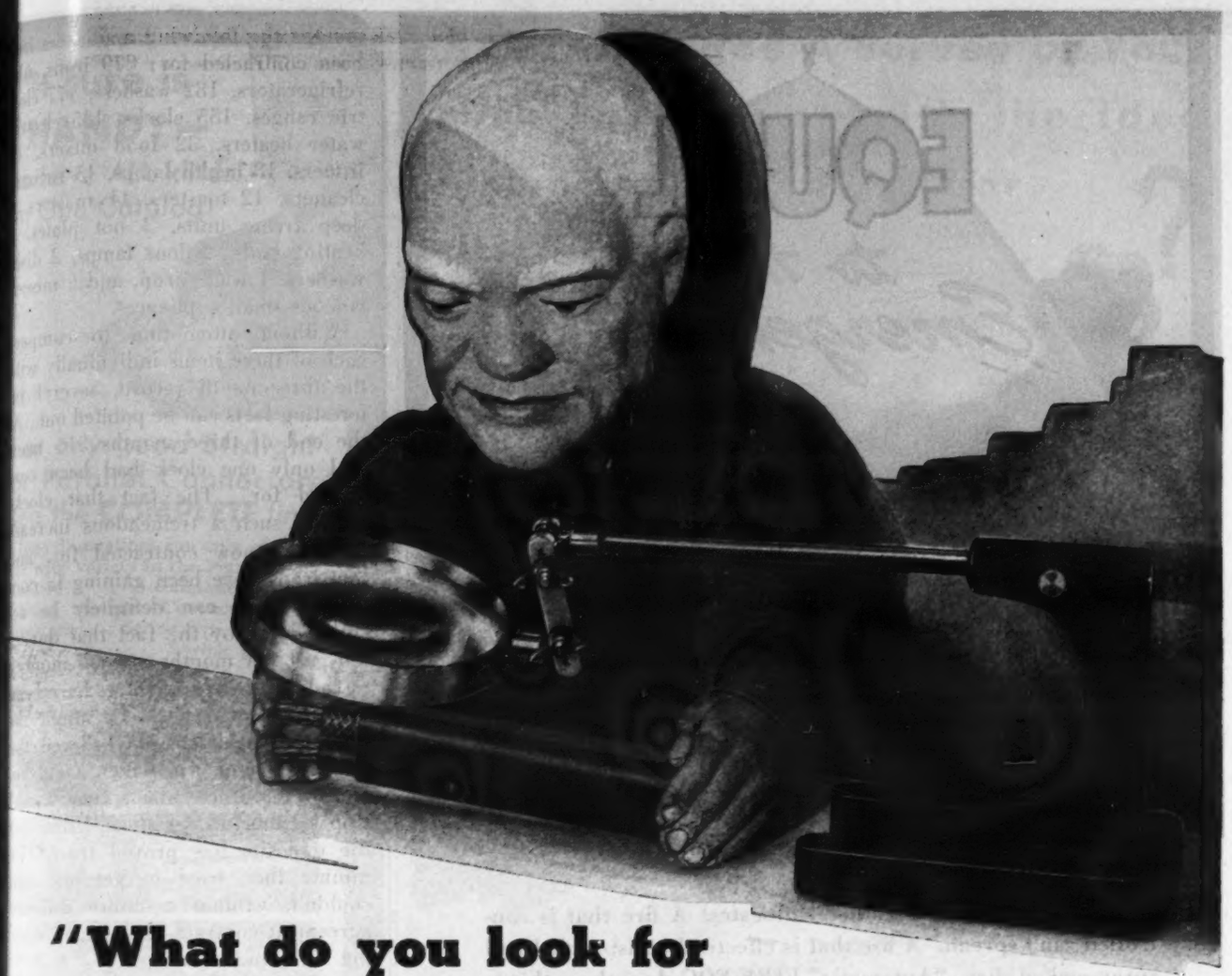
By KENNETH L. EDE
The Ohio Public Service Co., Cleveland, Ohio

From December first, 1943 to August first, 1944, contracts for electrical appliances have been signed by 2,265 of the approximately 100,000 residential customers of the Ohio Public Service Co. The total estimated sales price of the appliances covered by these contracts is $193,485.05. Possibly the most interesting fact is that the signers of these two thousand plus contracts paid a total of $32,362.53 down on their contracts and have paid an additional amount of approximately $40,000.00 in monthly payments to date.

To get some idea of the progress of the plan, a comparison with figures at the end of the first three months is interesting. In three months a total of 1,042 contracts had been signed, the total estimated sales price of the appliances signed for was $116,021, and $18,435 had been collected in down payments.

Putting the figures side by side indicates that while contracts are not being signed as rapidly as they were at first, there are still a lot of people interested in the plan, for the record of the last three months indicates an almost even leveling-off of contracts signed.

A study of the appliances represented by the 2,265 contracts provides perhaps an even more interesting comparison. At the end of eight



"What do you look for in a cable?"

asks *Rōmey

"What you're really looking for in a cable," says Romey, "are things that you can't see . . . things like long life, dependability, service.

"These qualities that you can't see will show themselves in the performance you'll get from a Rome Cable product.

"They're built right into it by our long and varied experience in designing and making conductors to fill the specific needs of customers in many fields of the electrical industry.

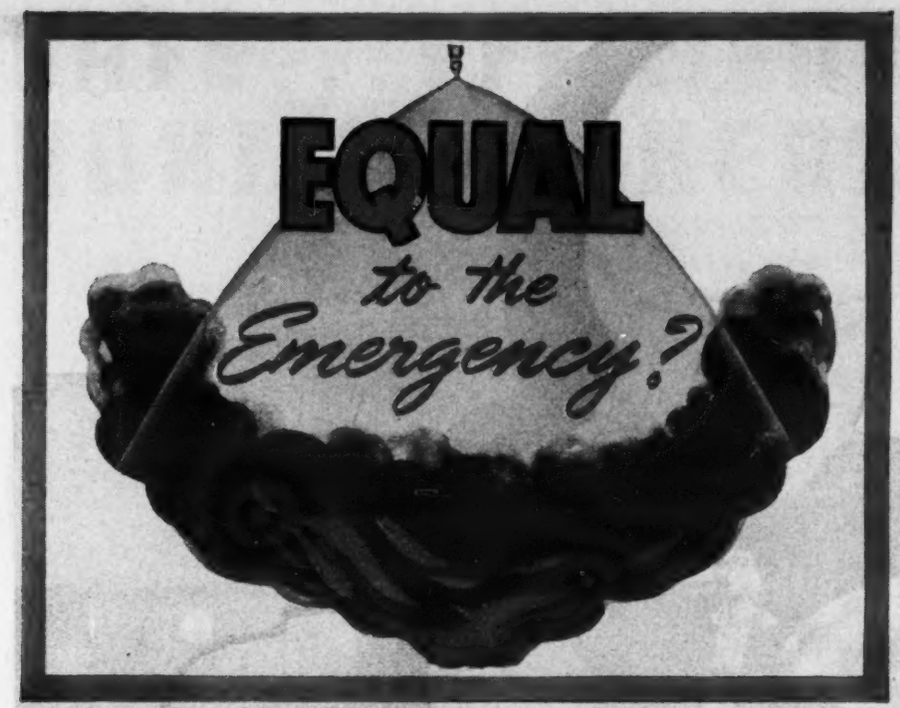
"Send us your inquiries."

*Copr. 1944 RCC

FROM BAR TO FINISHED WIRE

ROME CABLE CORPORATION

ROME • NEW YORK



"AUTOMATIC"
FIRE-FOG IS THE ANSWER

★ IT BLANKETS ★ IT ISOLATES ★ IT QUENCHES ★

● A fire that can't "breathe" suffocates. A fire that is controlled can't spread. A fire that is effectively mist-cooled and spray-soaked dies. "Automatic" FIRE-FOG does these things to oil and other flammable liquid fires!

Automatic in operation, swift in action, sure in performance, the FIRE-FOG system of protection is rapidly becoming indispensable in many plants. A fine mist does the work—cooling and beating down the flames—stifling the blaze through "oxygen starvation"—then completely enveloping the fire and extinguishing it. From fire-blaze to fire-quench takes only a few seconds!

You owe it to yourself, your plant and your personnel to become fully informed on the merits of an "Automatic" FIRE-FOG installation.

NOTE: Where such fire hazards as electric transformers, oil switches, generators or short circuits are present, an "Automatic" FIRE-FOG installation provides the protection needed. An "Automatic" engineer will be glad to give you complete information.

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA • YOUNGSTOWN, OHIO
• • • OFFICES IN PRINCIPAL CITIES • • •

AUTOMATIC SPRINKLER CORPORATION OF AMERICA — RATE OF RISE

months the following appliances had been contracted for: 879 irons, 610 refrigerators, 182 washers, 177 electric ranges, 155 clocks, 135 electric water heaters, 32 food mixers, 18 ironers, 18 health lamps, 15 vacuum cleaners, 12 toasters, 11 roasters, 6 deep freeze units, 3 hot plates, 2 heating pads, 2 floor lamps, 2 dishwashers, 1 waffle iron, and 5 miscellaneous small appliances.

Without attempting to compare each of these items individually with the three-month record, several interesting facts can be pointed out. At the end of three months 316 irons and only one clock had been contracted for. The fact that clocks showed such a tremendous increase with 155 now contracted for, and that irons have been gaining in contracts signed can definitely be accounted for by the fact that during the past few months a small number of each of these appliances have been available for sale. It might be thought that if people believed the time had come when they could begin to buy these items they would stop signing up for them. But just the opposite has proved true. The minute they tried to get one and couldn't, without a future delivery agreement contract, they began signing up rapidly.

Program to be Continued

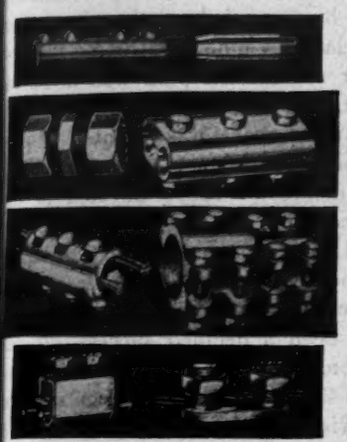
This proved that the gradual release of appliances would help rather than hinder the plan. For this reason the company is definitely going to continue the program as long as there is any shortage of appliances.

Another fact of interest is the small number of deep-freeze units contracted for. Considering that refrigerators lead major appliances by a wide margin, and that there has been a great amount of publicity regarding the advantages of frozen foods, the convenience of deep-freeze units, and the probabilities that many food companies would begin the widespread distribution of frozen foods immediately after the war, the fact that only six contracts have been signed for this appliance is perhaps surprising. It is even more surprising when you look back and see that nine deep-freeze contracts had been signed at the end of three months. In fact, deep-freeze units are the only appliance to show a decrease in contracts signed.

"It sure is HANDY— to have ALL kinds in One Catalog!"

For any good Straight or Parallel Connector, *see the* **COMPLETE** *line*

These illustrations can only suggest the wide variety in the Penn-Union Catalog . . . a *complete* line of Bolted Straight Connectors and Reducers . . . Screw type . . . Split Sleeve type . . . Shrink fit . . . Universal Parallel Clamps . . . E-Z Connectors that take a wide range of conductor sizes.



Also . . . the most complete line of Service Connectors, Tee Connectors, Cable Taps . . . Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs.

Penn-Union connectors are the first choice of leading utilities, industrials, electrical manufacturers and contractors—because they have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

Have You Made A Survey of Your Truck Equipment with the Idea of Meeting Your Post-War Requirements . . . . . ?

The American coach
REPLACEMENT PLAN
How About Your Equipment for "V" Day and the New Construction That Will Follow? The "AMERICAN" Plan Will Surely Help Solve The Problem

THE "AMERICAN" COACH REPLACEMENT PLAN

. . . described fully in the folder illustrated above, will enable you to get delivery of the Utility Bodies needed for servicing the many miles of new power and communication lines that will be required for the thousands of new projects envisioned for the post-war period. The American Coach Replacement plan was worked out and set up after a thorough research and analysis of field conditions.

Write, phone or wire today for copy of folder

Some Reasons Why "Americans" Are TOPS:—
Correct Design • Superior Quality Construction • Comfort • Convenience • Safety • Endurance • Low Operating Cost • Fine Appearance

THE *American* COACH & BODY CO.
PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES

CHAMPION
PERFORMANCE

Consistently among the leaders in the lamp industry for 44 years Champion **Incandescent**, and now *Fluorescent* Lamps are true "four letter champs" for industrial installations and replacements:

A. Champion in Quality because of modern production methods, skilled engineering resources and rigid testing facilities.

B. Champion in Service by virtue of a field force of trained experts, quickly available for consultation and assistance on any lamp or lighting problem.

C. Champion in Economy through lower cost per lamp, lighting efficiency considered.

D. Champion in Distribution with a competent supplier in your locality, meeting your lamp needs swiftly and efficiently.

Look for the Diamond trade mark on *Fluorescent* and Incandescent lamps. It's the mark of a CHAMPION.

CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

The fact that almost as many electric water heaters as ranges have been signed for indicates that this appliance is really beginning to take hold and that a real demand for it now exists. This is interesting in view of the sales resistance that has been met almost up to the beginning of the war.

As with the selling of actual appliances, there has been a great difference in the way in which different salesmen have taken hold of the plan. Altogether, 46 salesmen have closed future delivery agreement contracts. Three of these men have averaged $1,500.00 a month or more in signed contracts. Sixteen have closed contracts for over $5,000.00 worth of appliances in the eight-month period.

Plan Successful

Some part of the slowing up in the signing of contracts is due probably to the fact that very little advertising has been put behind the plan within the last few months. During the first four months the plan was in operation, a considerable amount of advertising space was devoted to promoting it. In fact, the total number of inches of space devoted to the plan during the first four months was 4,815 inches as compared with 2,72[illegible] inches during the last four months.

In general it is felt that the plan has been a decided success. It has accomplished its objectives of giving the salesmen something to sell; of providing a definite way by which a prospect can assure herself, without inconveniences on her part, of the appliance she wants; of providing an orderly method of delivering appliances when they do become available; and of siphoning off some of the excess money in circulation into an anti-inflationary program.

Finally, it might be interesting to state that only an extremely small percentage of individuals have missed payments on their future delivery agreements, or have dropped the plan. So, the customers seem to like it, too, and are continuing to participate.

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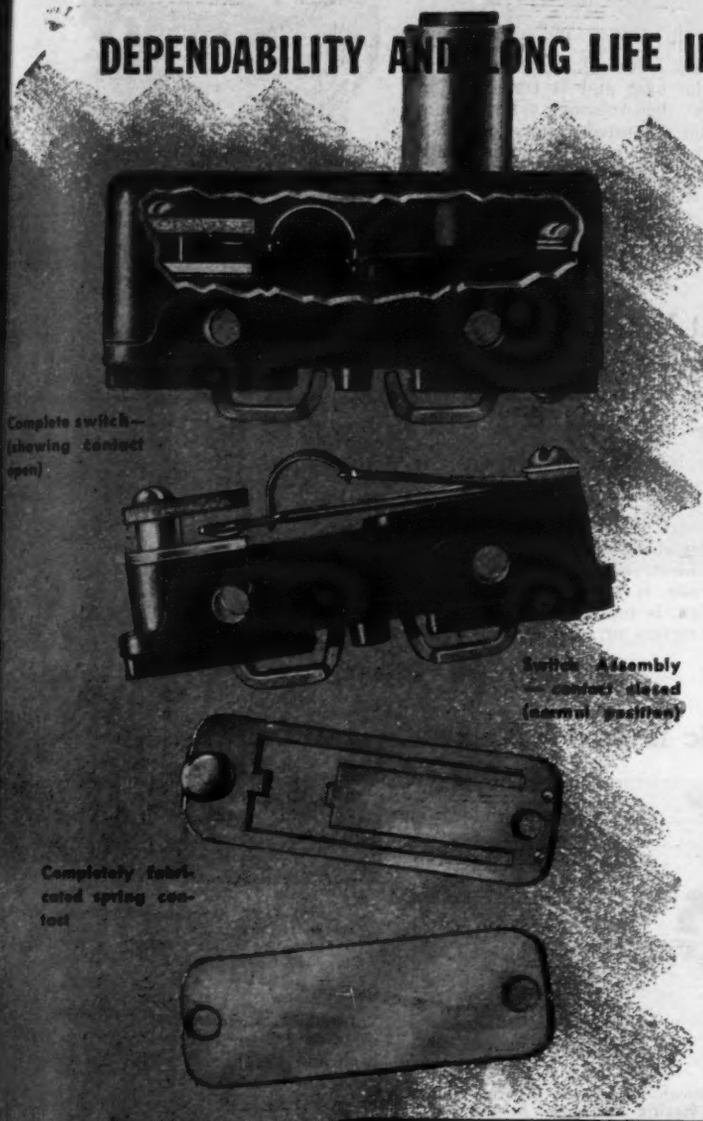
Electricity in Industry

Eighty percent of the industrial power used in the United States is electric.

Another product improvement through

BRIDGEPORT'S PHOSPHOR BRONZE

DEPENDABILITY AND LONG LIFE IN SWITCHES AND CONTROLS



Complete switch—(showing contact open)

Switch Assembly—contact closed (manual position)

Completely fabricated spring contact

Partially fabricated blank

This type of switch, manufactured by the Acro Electric Company, has won engineering acceptance in many industries for the control of automatically operated gauging equipment, safety and counting devices, and many hundreds of other important uses. Its accurate, dependable action is due largely to the resiliency and fatigue resistance of the contact spring, which is made from Bridgeport's improved Phosphor Bronze.

This type of switch is designed for operation by precisely controlled slight mechanical pressure and a movement of only a few thousandths of an inch. Therefore, the Phosphor Bronze spring must retain its accurate, dependable action under constant flexing of the "tongue" while the remainder of the spring bends in the opposite direction.

Bridgeport's improved Phosphor Bronze combines high strength with resistance to dampness, fumes, severe corrosion, and freedom from season cracking. Phosphor Bronze is tough as wrought iron, yet when soft annealed is so ductile that it can be easily formed or stamped into complex shapes.

Product designers and engineers interested in electric switches, radio and radar, relays, teletype, hearing devices, electric ranges, refrigerators, time recording equipment, and the like, should investigate the exceptional resiliency and fatigue resistance of Bridgeport improved Phosphor Bronze.

Mill orders accepted in accordance with existing priority regulations.

Phosphor Bronze

BRASS Bridgeport CO.

BRIDGEPORT BRASS COMPANY

NEW EQUIPMENT

Drum Handler

Telescopic Tilting Fork Truck equipped with drum handling device; **Yale & Towne Mfg. Co.**, Philadelphia 24, Pa.

Special short forks and a metal loop which is dropped over the barrel or drum by lever action after the forks have been slid underneath. This enables the operator to pick up the drums and transport them in and out of cars or storage without stepping off the truck. The device is removable from the standard constructed truck.

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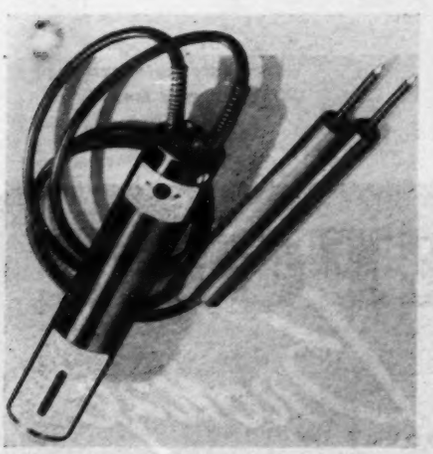
Voltage Tester



S.D.P.-2 Knopp Voltage Tester; 110 to 550 volts a.c.; 115 to 600 volts d.c.; neon light polarity indicator; **Electrical Facilities, Inc.**, 4236 Holden St., Oakland 8, Cal.

Tester which operates on the solenoid principle for detecting nominal a.c. and d.c. voltage values. Neon-light polarity indicator is in the base and is connected in parallel with the solenoid. Leads are reported to be separated from each other in the case. A junior model which is identical with the SDP-2 except that it does not have the neon-polarity indicator is also available.

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Constant Voltage Transformer

Constant voltage transformer; 6.3 v.; 17 v.a. output; **Sola Electric Co.**, 2525 Clybourn Ave., Chicago 14, Ill.

Constant voltage transformer rated at 6.3v., 17 v.a. output and is reported to maintain that value within one percent with line voltage variations up to 15 percent. Used for stabilization of E-C oscillator circuits. Electronic equipment in which this transformer is a built-in component of basic design, is reported not to require filament volt-meters or manual controls.

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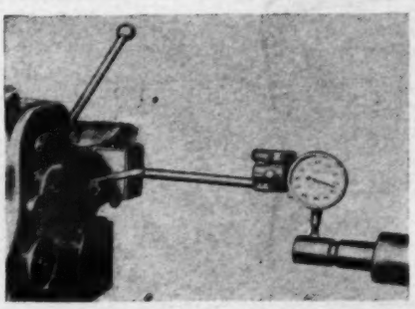
Magnetic Indicator Base

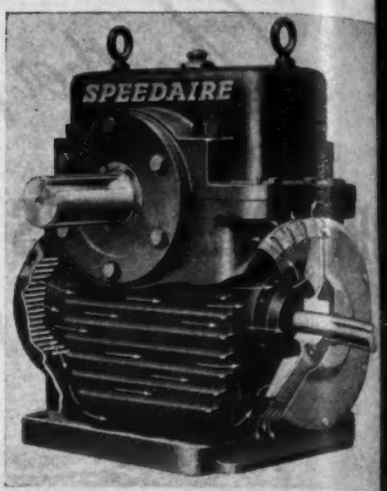


Magnetic indicator base; two "Alnico" magnets; **Main Electric Co., Inc.**, Rochester 2, N. Y.

The use of this unit is said to eliminate the need of clamps and allows easy access to places that would be impossible to reach. Magnets hold indicator to iron or steel surfaces. Strength is said to be ample to support the indicator at the extreme end of the post in any position. Magnet carries manufacturer's guarantee to remain at full strength for five years.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Worm Gear Reduction Un



"Speedaire" Reduction Unit; fan cooling; double wall construction; **Cleveland Worm & Gear Co.**, Cleveland 4, Ohio.

A worm gear reduction unit which has a double wall construction that provides an air passage completely enveloping the oil reservoir in which the gears operate. The inner housing wall is finned on the air side. Exhaust fan is located on the coupling end and is designed to operate in either direction.

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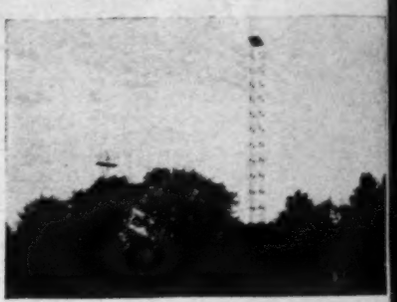
Towers



"Bantam King" steel towers: heights 30, 48, and 96 ft.; wood platform 4 x 8 ft. with 3 ft. high pipe rail. **Harco Steel Construction Co.**, 1180 East Broad St., Elizabeth, N. J.

Steel towers 4 ft. square for portable or permanent installations feature ease in erection by interchangeable sections 6 ft. high and weighing 112 lb. The design provides for a wind velocity of 100 miles per hour. Three different members use—tubular corner posts, horizontal channels and diagonal flats. Each tower includes in its equipment—base, fittings, turnbuckles, guys, ground anchors, boom, winch, platform and frame. They are said to be suitable for VHF and FM radiators.

•

Control

Automatic Imputrol; 110 v. or 220 v.; 25 or 60 cycle; wt. 25 lbs.; **Wheelco Instruments Co.**, Chicago 7, Ill.

An electrical timing device which, with any automatic control instrument having a high and low contact with a neutral position, is said to control the input of electri-

"Making Big Ones out of Little Ones"

With most of our lumbermen handling knives and walnut gun stocks instead of axes and cedar, pole replacements are somewhat of a problem in many localities. Add to this, the difficulties of shipping and handling heavy materials amidst war time traffic congestion and the result is a scarcity of poles for some of our Utility Companies.

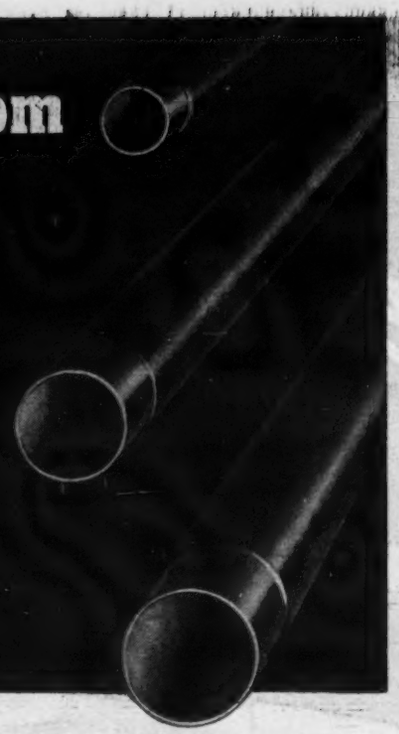
The problem is being partially solved on a temporary basis by pole stubbing. Discarded poles with rotted bottoms but firm wood above the original ground line are used as stubs. After cutting away the rotted butt and treating, stubs are set alongside the pole which is in service but in need of replacement. Hubbard Sleeve-Nut Bands are installed as shown in the diagrams.

Given a solid setting for the stub, the resultant structure will hold to the breaking strength of the average pole, as illustrated by the accompanying photo of a test.

HUBBARD AND COMPANY

PITTSBURGH OAKLAND CALIFORNIA CHICAGO

Protection from CABLE ABRASION Now . . . and Years from Now!



Scoring of sheath, the first hazard in the life of a cable, is at a minimum when cable is pulled through Orangeburg Conduit.

ORANGEBURG FIBRE CONDUIT is non-abrasive and has a low coefficient of friction. Pulling tensions are kept low, preventing undue strains in cable. A typical Orangeburg installation by one large utility, where cable tensions were carefully watched, showed the following results:

Size of Cable	*Size of Duct*	*Length of Pull*	*Coefficient of Friction*
300,000 c.m. 2¼" O.D.	3½"	800-900 ft.	.25 – .30
650,000 c.m. 2½" O.D.	4"	800-900 ft.	.25 – .30

A recheck of this installation two years later showed that the coefficient of friction was unchanged.

ORANGEBURG FIBRE CONDUIT is non-corrosive. Made only of cellulose fibre and coal tar pitch, ORANGEBURG does not require curing; nor is it subject to changes which might release salts injurious to cable sheath.

ORANGEBURG FIBRE CONDUIT is non-corrodible. Ground waters or wastes, entering the manholes or ducts do not disintegrate it or form corrosive by-products which might react unfavorably on cable sheath.

ORANGEBURG STANDARD for installation *with* concrete encasement

•

ORANGEBURG NOCRETE for installation *without* concrete encasement

ORANGEBURG FIBRE CONDUIT is non-metallic, non-cementitious and non-conductive. It is unaffected by electrolysis, and does not of itself act as an electrolyte.

ORANGEBURG FIBRE CONDUIT is easy to install. The taper sleeve joint assures accurate alignment of lengths for a continuous and true raceway.

ORANGEBURG is economical—low in first cost, low in ultimate cost as proved by over 50 years' service in the underground protection of electrical cables.

Write for new Catalog No. 49.

THE FIBRE CONDUIT COMPANY • ORANGEBURG, N. Y.

GENERAL ELECTRIC SUPPLY CORP. *Distributors* GRAYBAR ELECTRIC CO., INC.

ORANGEBURG FIBRE CONDUIT

THE FIBRE CONDUIT CO. ORANGEBURG EST. 1893 ORANGEBURG N.Y.

ORANGEBURG

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

cal power, heat, flow of liquid or gas to any process or equipment. On an electric furnace of 100 kw. capacity, operating with small load at reduced temperature, it is said to control the input so that the consumption will be in proportion to that required to maintain the desired temperature.

•

Oil Heating Unit

Model "S-12" automatic oil circulating and heating unit: three temperatures pre-selected between 200 to 500 deg. F.; capacity 12 gal.; electric heaters 12.8 kw. total; rotary pump direct connected to ½ hp. 1,150 r.p.m. motor. **Youngstown Miller Co.**, Sandusky, Ohio.

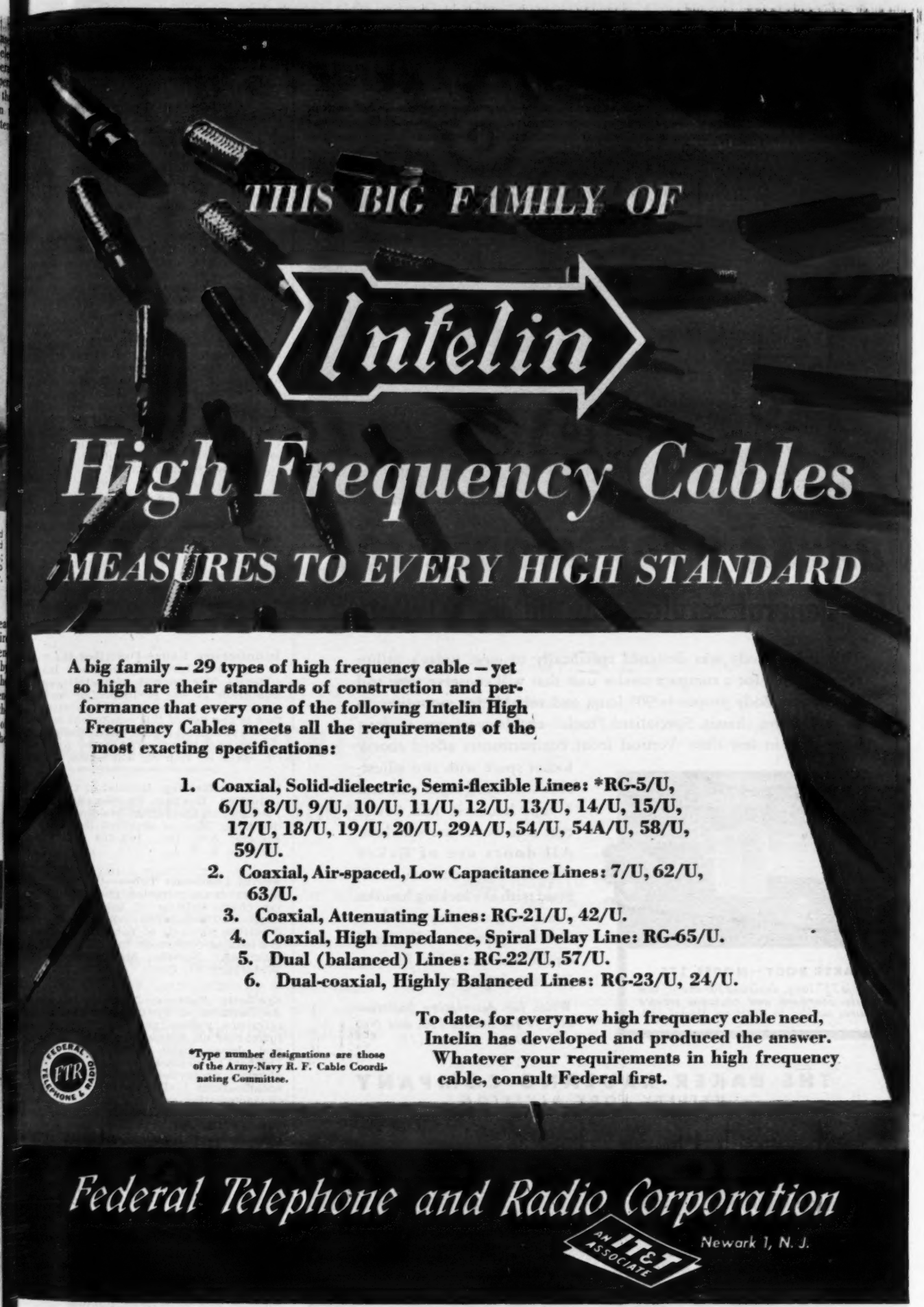
Unit has been designed to provide heat transfer oil to machines which require elevated temperatures. Selector switch enables changing controlled temperature by putting either of three thermostats in the electric circuit. Another selector switch enables operating with circulating pump without heat, a portion of heaters, and all of the heaters; lighted jewels signal the setting. Float inside indicates oil level.

•

Hf. Equipment

No. 2-P Model hf. preheating equipment; 25 to 30 mc.; 230 v.; 60 c.; time 5 sec. to 2 min.; size 28 in x 28 in. x 47 in. high; wt. 614 lbs.; **Girdler Corp.**, Louisville, Ky.

Single phase unit applicable to hf. preheating of plastic preforms. Has built-in heating cabinet and removable 12-in. x 15-in. drawer-electrode. It is reported to be automatic. Closing drawer all the way in closes switch and cuts in timer. Red light gives operator visual indication of time cycle completion.



THIS BIG FAMILY OF

Intelin

High Frequency Cables

MEASURES TO EVERY HIGH STANDARD

A big family — 29 types of high frequency cable — yet so high are their standards of construction and performance that every one of the following Intelin High Frequency Cables meets all the requirements of the most exacting specifications:

1. **Coaxial, Solid-dielectric, Semi-flexible Lines: *RG-5/U, 6/U, 8/U, 9/U, 10/U, 11/U, 12/U, 13/U, 14/U, 15/U, 17/U, 18/U, 19/U, 20/U, 29A/U, 54/U, 54A/U, 58/U, 59/U.**
2. **Coaxial, Air-spaced, Low Capacitance Lines: 7/U, 62/U, 63/U.**
3. **Coaxial, Attenuating Lines: RG-21/U, 42/U.**
4. **Coaxial, High Impedance, Spiral Delay Line: RG-65/U.**
5. **Dual (balanced) Lines: RG-22/U, 57/U.**
6. **Dual-coaxial, Highly Balanced Lines: RG-23/U, 24/U.**

***Type number designations are those of the Army-Navy R. F. Cable Coordinating Committee.**

To date, for every new high frequency cable need, Intelin has developed and produced the answer. Whatever your requirements in high frequency cable, consult Federal first.

FEDERAL TELEPHONE & RADIO — FTR

Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE

Newark 1, N. J.

FOR BETTER UTILITY SERVICE

BAKER BODY-MODEL 190

for general service and meter installation

This Baker Body was designed specifically to meet today's utility requirements for a compact service unit that will conserve time and manpower. Body proper is 90" long, and suitable for mounting on ¾ and 1 ton chassis. Specialized "tools" enable workmen to do a better job in less time. Vertical front compartments afford roomy locker space with two adjustable shelves in right side and 4 rope hooks in left. Lower rear side boxes are standard. All doors are of Baker Weathertight construction, fitted with key locking handles —assuring safe, dry and dust-free compartments. Optional equipment available for any job requirement.

BAKER BODY—MODEL 175
Body is 75" long, designed for the ½ ton chassis. Standard and optional service features similar to those on Model 190.

Write for descriptive bulletins No. 45 for Model 190, and No. 50 for Model 175.

THE BAKER-RAULANG COMPANY
UTILITY BODY DIVISION
1284 WEST 80th STREET • • • CLEVELAND, OHIO

Dependable AS THE SERVICE THEY HELP TO MAINTAIN

Baker BODIES AND EQUIPMENT FOR EVERY UTILITY PURPOSE

TECHNICAL LITERATURE

Plastic Board—Bulletin 6 contains tabl of physical properties of a light-weigh laminated lignin plastic which is resistan to water, oil, grease and dilute acids. Al contains information on and instructions for sawng, turning, drilling, tapping threading and milling the material. Ma be procured from Wales-Strippit Corp. North Tonawanda, N. Y.

Infra-Red—The Rewards of Industria Efficiency, bulletin 344, published by Fo toria Pressed Steel Corp., Fostoria, Ohio contains a step-by-step story of infra-re and how it can be made to work efficientl on industrial baking, drying, dehydratin and preheating problems.

Water Flow—Bulletin 420 obtainabl from Simplex Valve and Meter Co., 60 Upland St., Philadelphia 42, Pa., is a engineering approach to the turbine flo rate measurement problem by W. K principle. Describes how meter indicate records and totalizes flow rate measure ment of differential taps in the wate turbine. Contains an interesting compari son between kilowatt output chart and turbine water input chart.

Worm Gear Reduction—Catalog 30 issued by The Cleveland Worm and Gea Co., Cleveland, Ohio contains a compre hensive exposition of fan-cooled worm gear reduction units. Following the ex planatory and descriptive material, th design engineer will find carefully detailed instructions for planning installations o units. Supplementing these are ratin tables for sizes ranging from 4¾ to 12 inch centers.

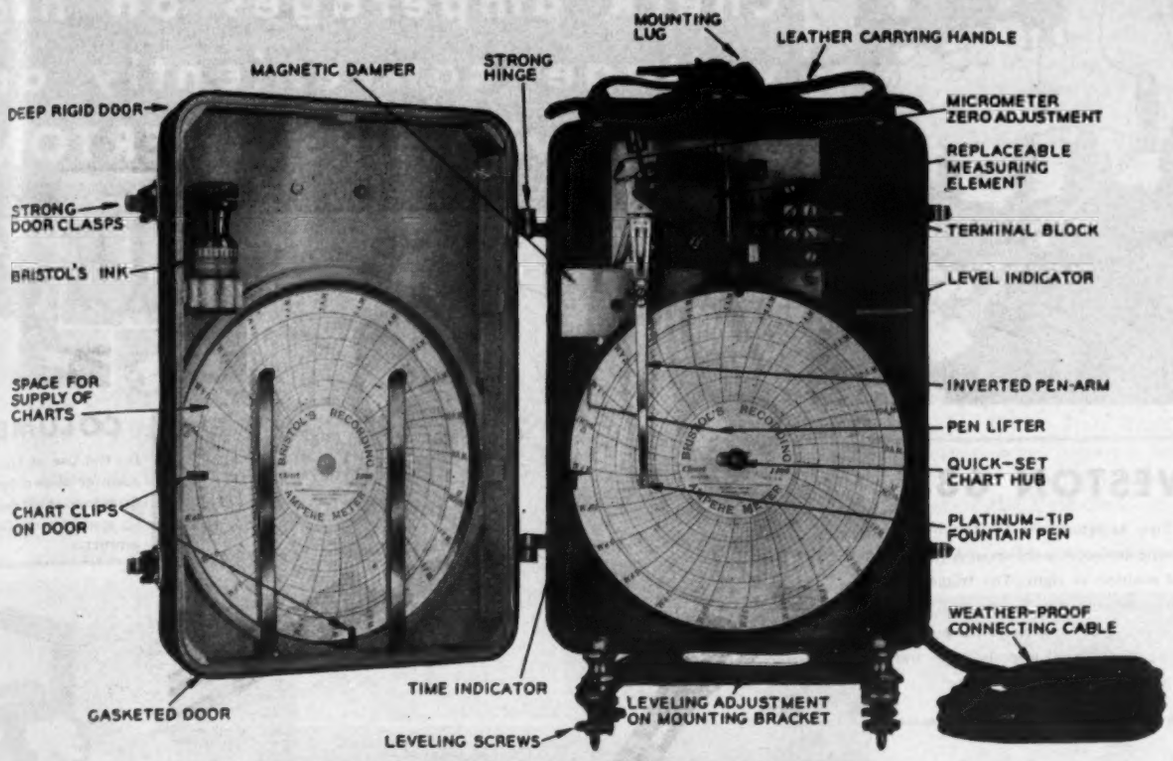
Disinfectaire Units—Describes the nature of air-borne bacteria and their inaccessibility. The method of installation and limitation of use in inspection and con tamination is also treated. Interesting fact is the use of this equipment in indus trial plants, schools and institutions. Copies can be procured from Art Metal Co., 1814 E. 40th St. Cleveland, Ohio.

Induction Heating—Booklet of 28 pages on Induction Heating by the Smith-Dolan Process for preheating, welding, and nor malizing. May be obtained by addressing Electric Arc, Inc., 152-158 Jelliff Ave., Newark, 8, N. J.

Scovill Condenser Tubes—Gives data and discussion on corrosion phenomena, tabu lar characteristics of tube alloys, tech nique of installation, specifications and describes methods of fabrication. Appen dix carries conversion tables, weights and formulas. Scoville Manufacturing Co. Waterbury 91, Conn.

Synthetic Rubbers—"Symposium on the Applications of Synthetic Rubbers" is a reference volume providing technical in formation on subjects such as the origin and development of synthetic rubbers (Fisher); physical testing (Cooper); physical properties (Ball and Maassen); specifications (DeFrance); processing characteristics and the use of synthetic rubbers in manufacture of extruded prod ucts (A. E. Juve); use in the wire and cable industry; molded products. Copies of the 140-page publication can be ob tained from American Society for Testing Materials, 260 South Broad St., Philadel phia 2, Pa.; price $1.50 per copy with paper binding.

"Selenium Rectifiers," bulletin RDP-105, issued by Fansteel Metallurgical Corp., North Chicago, Ill., contains technical in formation, wiring diagrams, specifications on d. c. power units for solenoids, relays, motors, chucks, magnetic devices, battery charges, and emergency lighting systems.



Inside Facts about Bristol's Model 622MP Portable Recording Ammeter

EEPS YOU UP-TO-THE-MINUTE

N CURRENT EVENTS

. . any place, any time!

a pole, down a manhole, mounted on a wall, nding on a table or placed on a damp cellar or, Bristol's Portable Recording Ammeter re-onds instantly and accurately to the slightest ctuation in current . . . signals circuit overloads gives time to fix things up before serious dam-e is done. This 17-pound package of trouble-ooting efficiency is built to take rough treatment d give accurate records in return. Here's what mean:

LOCKING DEVICE
Movement can be rigidly locked to prevent damage while traveling by truck from one location to another.

GASKETED DOOR
The snug-fitting door shuts out moisture, corrosive gases and dust. So — it's right at home outdoors or in damp cellars or manholes . . . without further protection.

MAGNETIC DAMPER
The damping effect, derived from Alnico permanent magnets, speeds response to ½ second for full deflection. Is practically unaffected by temperature.

REPLACEABLE MEASURING ELEMENT
You can replace the measuring element simply by removing the screws and dropping in a new unit in a few minutes without disturbing the case.

Available in one-, two- and three-pen models for ranges up to 10,000 amperes, Bristol's Portable Recording Ammeters are well worth investigating further. Bulletin 543 makes interesting reading. Write for it today.

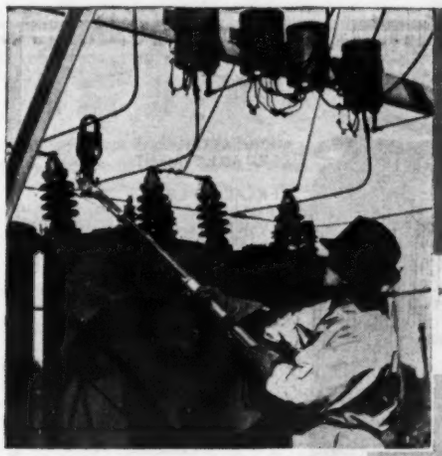
BRISTOL

THE BRISTOL COMPANY
116 BRISTOL ROAD, WATERBURY 91, CONN.

The Bristol Co. of Canada, Ltd., Toronto, Ontario

Makers of Metameter, Recording Voltmeters, Ammeters, Thermoverter, and a broad line of Automatic Controlling and Recording Instruments

Bristol's Instrument Co., Ltd., London, N. W. 10, England



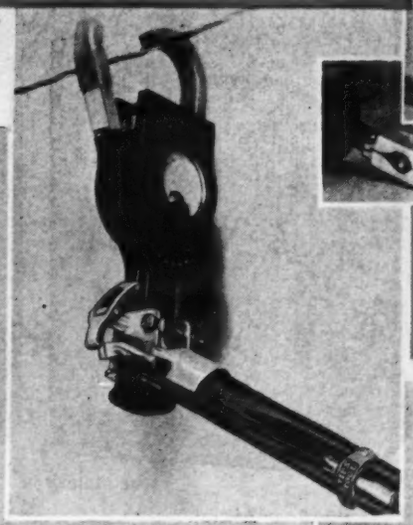
Check amperages on high voltage—conveniently and safely with TIPS AMERTONG

COLUMBIA

By the use of the simple adapter shown here, the Amertong at left can be easily applied to the Columbia ammeter.

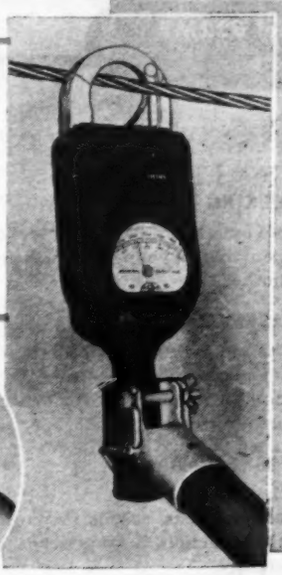
WESTON 633

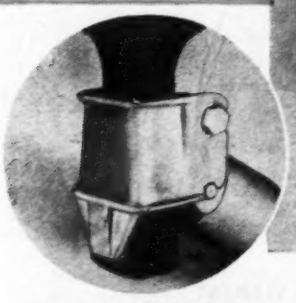
The Tips Amertong for Weston Model 633 clamp ammeter is shown in open and closed position at right. The trigger on the Weston ammeter is operated by a lever which opens and closes the ammeter jaws as the hand grip slides up and down the pole.



G. E. AK-1

The Tips Amertong for General Electric's volt ammeter AK-1, shown at right, does not require the leverage device. This tool is quickly applied and securely clamped to the handle of the AK-1 by a wing nut.





FERRANTI

The fitting shown in the circle above makes the Amertong, at left, quickly adaptable to the Ferranti ammeter.

"Hot Stick" operation for split core Ammeters

The Tips Amertong extends the use of split core ammeters by making it possible to measure current distribution on high voltage in absolute safety and to take readings from conductors that are otherwise difficult to reach. This handy tool is used as an aid and protection in checking sub-station buses, transformer leads, branch feeders, distribution lines, and conductors in inaccessible places.

By the use of adapters for various makes, the lever type Amertong is adaptable to Weston, Columbia, and Ferranti ammeters.

The General Electric tool has a similar clamp arrangement but does not require the lever equipment.

The clamps on all Tips Amertongs are pitched to hold ammeters at a 120° angle for convenience in reading. There is a minimum of metal for the sake of safety. The laminated plastic lever on the Weston, Ferranti, and Columbia type Amertong is connected to the hand grip by a laminated plastic pull rod. These plastic pieces are of high dielectric strength and the laminated spruce pole is tested to withstand 75,000 volts per foot.

Metal parts are aluminum for light weight. Poles are standard in four or six foot lengths. A felt pad protects ammeter handles.

Put ammeters to greater use and protect operators with Tips Amertongs.

A·B·CHANCE CO.
CENTRALIA, MISSOURI.

CONSULT YOUR TIPS TOOL CATALOG OR WRITE FOR MORE COMPLETE DETAILS

NEWS ABOUT PEOPLE

sumers Power Elects Brown Vice-President

ection of James A. Brown as vice-dent of the Consumers Power Co., on, Mich., was recently announced. Brown, who has been associated Consumers and with affiliated com-

es for 34 years, assumes the place he organization left vacant when er H. Sammis resigned recently to me president of the Ohio Edison With offices in New York he will inue as chief gas engineer for the monwealth & Southern Corp. and president of the Southern Indiana & Electric Co.

•

L. SMITH, acting treasurer of the erior Water, Light & Power Co., erior, Wis., has been made treas-

ESTER M. SMITH has been appointed ctor of public relations of the Ala-a Power Co., Birmingham, accord-to Thomas W. Martin, president the utility, who announced the blishment of a department of pub-relations. A native of Alabama and raduate of the University of Ala-a, Mr. Smith has been with the bama Power Co. since 1923, having engaged in engineering work and he outside activities of the company. For the past year he has given most of his time to the work of the Committee for Economic Development, of which Mr. Martin is regional vice-chairman.

▶ JOE FOX, division sales manager for the Washington Water Power Co. at Pullman for several years, has been transferred to the company's office at Lewiston.

•

Frank R. Innes Named Associate Editor

Frank R. Innes, for the past five years managing editor of ELECTRICAL WORLD, has been advanced to the position of associate editor to take charge of the expanded treatment which the magazine is preparing to give to utility com-

mercial activities. The reduction in industrial consumption which will result in the reconversion from war to peace production is expected to place load building in the position of greatest importance to the electric light and power industry.

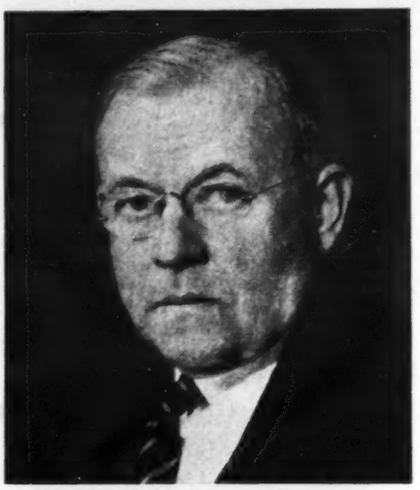
Mr. Innes, who will sponsor this work, brings to it a background of nearly 20 years of editorial experience and a wide knowledge and sympathetic understanding of the problems of the utility industry. He joined the staff of ELECTRICAL WORLD in 1925, going to Chicago the following year as western editor. Since 1939 he has been managing editor. Before taking up editorial work he was employed for a number of years by the Detroit Edison Co. and by the Sessions Engineering Co.

•

Nickerson Retires As Consolidated Official

Announcement has been made of the retirement of Franklin H. Nickerson as vice-president and trustee of Consolidated Edison Co. of New York, Inc. Mr. Nickerson was honored on September 8, by his company associates at a dinner at the Pelham Country Club in Westchester County.

All but three of Mr. Nickerson's forty-



seven years of service with the Edison System Companies have been in accounting, statistical and financial work. He was made vice-president in charge of finance and statistics of the Consolidated Gas Co. in 1929, and since the 1936 mergers which brought about the present corporate set-up he has been vice-president of Consolidated Edison Co. responsible for regulatory, statistical, tax and related matters.

For many years it was his duty to make a continuous study of the financial requirements of the gas and electric companies in the Edison System to determine needs for working capital and other purposes. He frequently testified in court proceedings and in hearings before the Public Service Commission in merger, rate and capitalization matters.

Mr. Nickerson has been a trustee of the Consolidated Edison Co. of New York since 1936. He has also been a director of the Brooklyn Edison Co., New York and Queens Electric Light & Power Co., New York Steam Corp., and Westchester Lighting Co. He was a director of many of the gas and elec-

O. Z. Cast Iron Junction Boxes

are designed by engineers whose experience covers a quarter of a century of service to the electrical construction industry. These boxes bear the stamp of high quality material, working efficiency, and lasting service under diverse operating conditions. Special types are recommended for railways, docks, bridges, underground systems, industrial plants, and highways.

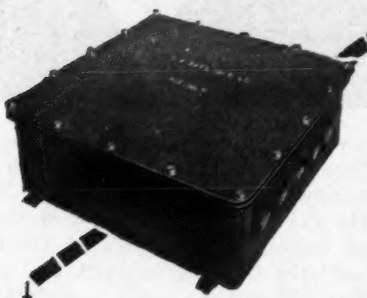
O. Z. anticipating an upward trend in building and construction, has expanded its line of electrical fittings to include a complete range of types and sizes of Junction Boxes, both of standard design, or built to individual job requirements.

O.Z. JUNCTION BOXES

Standard . . . or to Your SPECIFICATIONS

This weatherproof pull box can be used with cut-outs, terminal strips, or other equipment. One piece rubber gasket in the groove of the cover makes a waterproof box.

An adaptation of one of our regular boxes fitted with an O. Z. distribution center and flanged wiping caps.



Heavy Duty Type Junction Box. Can be used for surface or flush mounting. Available with rubber gasket (as shown) or with raised cover for heavy explosion-resisting work.

This new Flange Type Wiping Cap has been added to the regular O. Z. Wiping Cap line. Adaptable for use with Junction Boxes.

MORE THAN A CATALOG

This new O. Z. publication contains 144 pages attractively bound in loose-leaf form. More than 160 O. Z. electrical fittings are described, illustrated, with photo diagrams, specifications and prices. Included are O. Z. Conduit Fittings . . . Cable Terminators . . . Solderless Connectors . . . Power Connectors . . . Grounding Devices. Designers, engineers and contractors in the electrical field are offered this valuable guide at no cost. Send for your copy.

O.Z. ELECTRICAL MFG. CO.

262 BOND STREET BROOKLYN, 2 N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

tric companies which were merged Consolidated Edison Co. of New Y in 1935 and 1936.

•

G. V. Williamson Promote by Union Electric C

G. V. Williamson of the Union E tric Co. of Missouri, has recently l placed in charge of all steam po engineering which comes under scope of the company's power prod

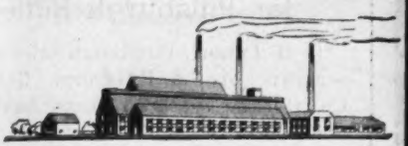
tion division. He heads the new ste operation engineering department, centralized technical engineering gro which will function in the fields of ste plant results, loadings, economy, ma tenance technique, plant and equipm developments, chemistry, operating tistics and other related matters.

•

▶ GEORGE L. HOUSTON, power pl chemist, combustion and results en neer, Central Maine Power Co., W casset, has joined the engineering st of The United Illuminating Co., N Haven, Conn. He was graduated fr the University of Maine in 1937, a before becoming connected with C tral Maine Power, was night sup intendent and previously a member the engineering department of the Al Plywood Co., Howland, Me.

▶ ROBIN BEACH, head of the electri engineering department at the Po technic Institute of Brooklyn, has ganized the consulting engineering fi of Robin Beach Engineers Associat with headquarters at 32 Court Str Brooklyn, N. Y. The new organizati will offer engineering services in pl ning industrial conversions; couns ling on procurements of or participati in manufacturing facilities and ind trial processes; training supervisors a rehabilitating veterans for industr preparing market surveys; recommen ing safety practices and codes and se

This APEXIOR coating on a plant boiler of a candy factory has been in service for 9 years without renewal. Operating pressure, 250 lbs.



HOW TO PREVENT WAR-STRAINED BOILERS FROM BOGGING DOWN

Under three-shift operation . . . a boiler may be called upon to evaporate three times as much as normally required. This means three years' work in one and because of severe overloads, probably more than three times as much wear.

In hundreds of industrial plants APEXIOR is one of the most important factors today in keeping boilers in service. It not only prevents serious corrosion — thus assuring uninterrupted operation and longer life — but also prevents tight bonding of water scale, extending the length of time between cleaning and making cleaning faster and easier.

Whether or not you have a high priority rating, uninterrupted boiler service justifies every possible safeguard and self-preservation justifies every protection of your boiler.

APEXIOR Prevents Corrosion for 2-3 Years

APEXIOR NUMBER 1 is brush-applied by hand or power coater. It fills in the pores and joints of all hot-wet surfaces, forming an impenetrable barrier against water. There is less adherent scale.

This tough, smooth coating is not affected by high temperatures or ratings, by chemical treatment of boiler water or by varying feedwater conditions. It does not retard heat transfer in operation.

APEXIOR Easily Renewed

The life of the application varies with the service and wear. It will last 2 or 3 years, often much longer.

Save Materials — Man Power

Apexiorize your boilers. Keep the metal young. Avoid damage and wasted man power that cannot be measured in dollars.

Write for Bulletin 1290 containing facts on a paint that fortifies metal against the ravages of war schedules.

Users like these have applied APEXIOR for years

Pontiac Motor Division

Portland General Electric Co.

Hercules Powder Co.

Gulf Shipbuilding Corp.

The Pullman Company

International Paper Co.

Socony Paint Products Co.

Sears, Roebuck & Co.

The Stanley Works

Combustion Engineering Co., Inc.

American Viscose Corp.

Curtiss Wright Corp.

APEXIOR

A Peacetime Plus ★ ★ ★ A Wartime Must

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

The **DAMPNEY COMPANY of America**

protective coatings for

STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

THE DAMPNEY COMPANY OF AMERICA
Hyde Park 36, Mass.

Please send free Bulletin 1290 (Industrial) ☐ 1305 (Marine) ☐

Name.....

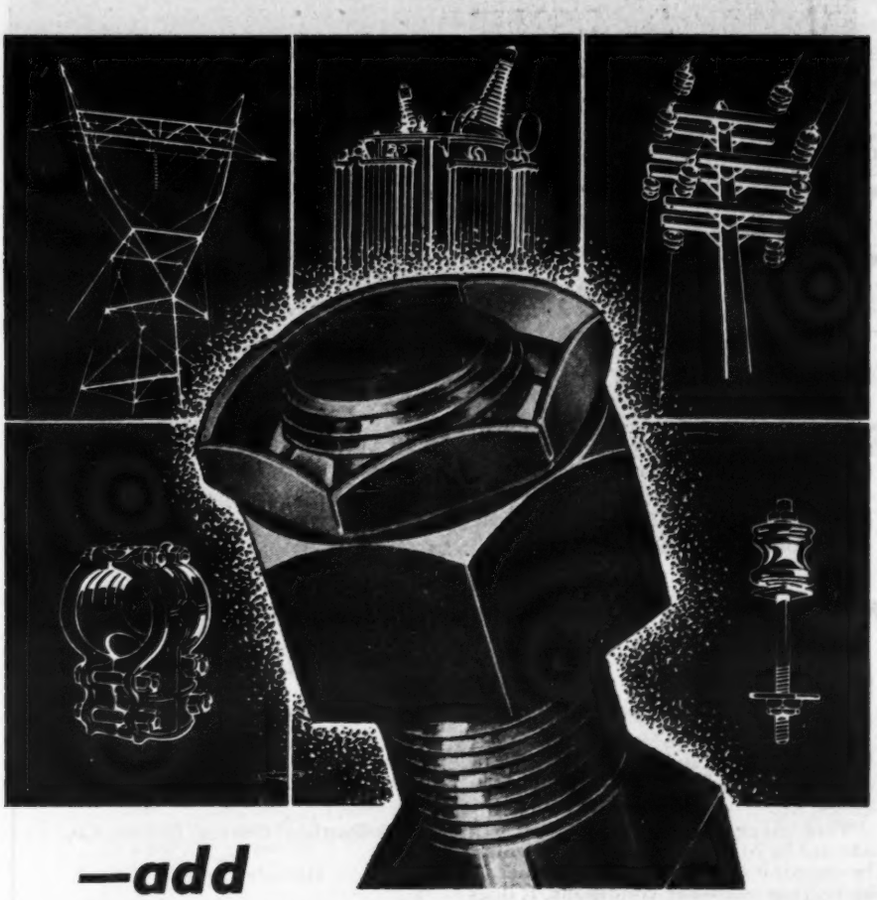
Company.....

Address.....

Main Office: **HYDE PARK • BOSTON 36, MASS.** • *Branch Offices:* **ATLANTA • CHICAGO • NEW YORK • DETROIT • PHILADELPHIA**

Engineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Honolulu, T. H., Marine Dept., 114 Liberty Street, New York City, N. Y.

Where Assemblies MUST stay tight—

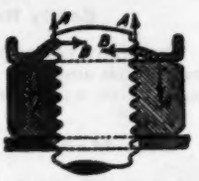


—add DOUBLE LOCKING PALNUTS!

Tight assemblies and connections are vital in power transmission, distribution and electrical equipment. Fortunately, there is a simple, effective, low-cost answer to this problem . . . Double Locking PALNUTS, used for years on wood pole lines, steel towers, transformers, switches, bus fittings and connectors and other electrical equipment.

PALNUTS are single thread locknuts, of tempered spring steel or Duronze. Quickly applied on top of regular nuts, they hold parts to original tightness, despite severest vibration. PALNUTS are light in weight, low in cost, require only 3 bolt threads space, may be re-used. Specify PALNUTS on equipment you buy—use them on equipment you build. Write for PALNUT Manual No. 1 giving full details.

THE PALNUT COMPANY **51 Cordier St.**
Irvington, N. J.

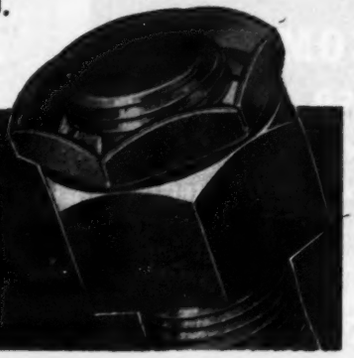


DOUBLE LOCKING ACTION

When the PALNUT is tightened, its arched, slotted jaws grip the bolt thread like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the regular nut (A-A), securely locking both.

Used Today on Aircraft, Tanks, Jeeps, Military Vehicles and other War Equipment

DOUBLE-LOCKING **PALNUTS**



ing specialized problems in electrostatic elimination, electronic controls, and power installations. In the course of his career, Mr. Beach has engaged in appraisal service and engineering investigations and has served as educational director for Brooklyn Edison Co. and Consolidated Edison Co. He is a fellow of the American Institute of Electrical Engineers.

•

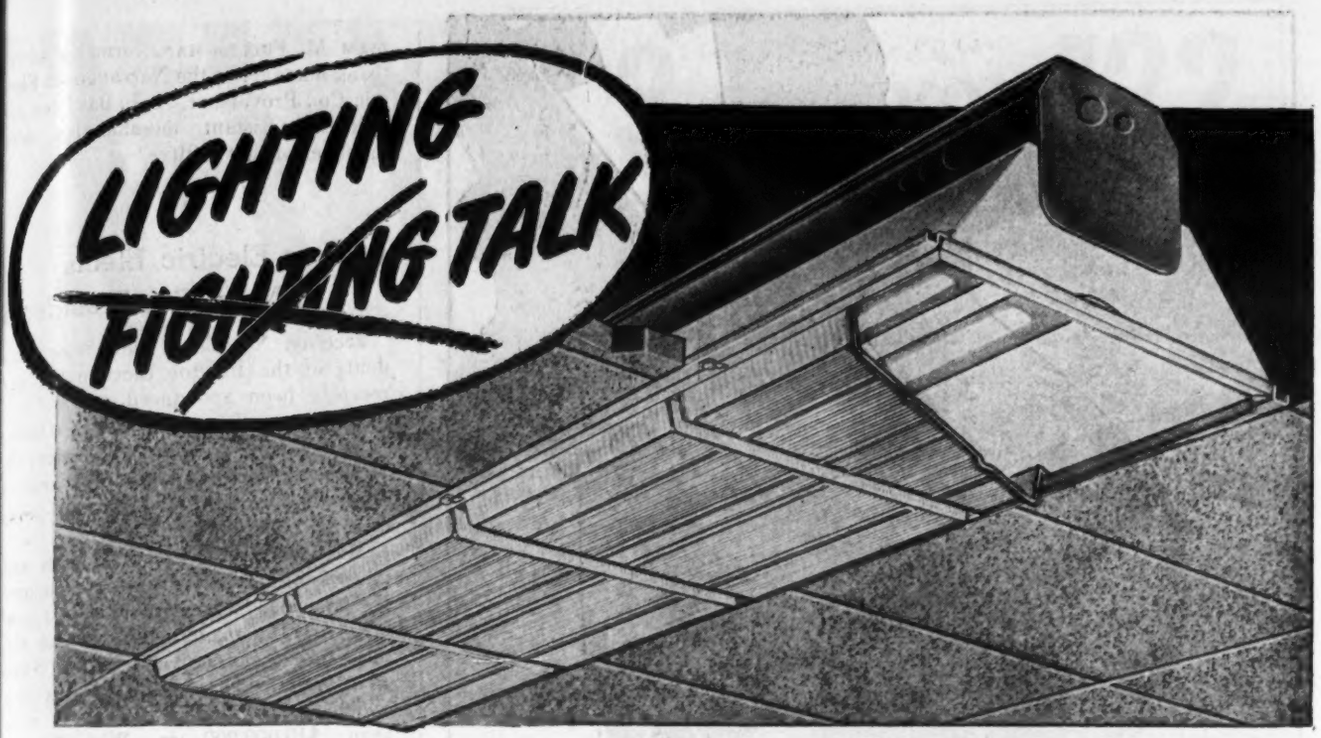
Levaur Will Direct Sales for Pittsburgh Reflector

B. D. Levaur, Pittsburgh sales representative of the Pittsburgh Reflector Co., for the past 18 years, has been made vice-president, director of sales, and a member of the board of directors, President H. C. Zinsmeister announced recently.

A graduate of the University of Pittsburgh, Mr. Levaur joined the company in 1926. Since then he has been responsible for some of the country's largest lighting installations. He has solved many new illuminating engineering and design problems for the armed forces since the beginning of American rearmament. He will make his headquarters at the Pittsburgh office but will travel extensively.

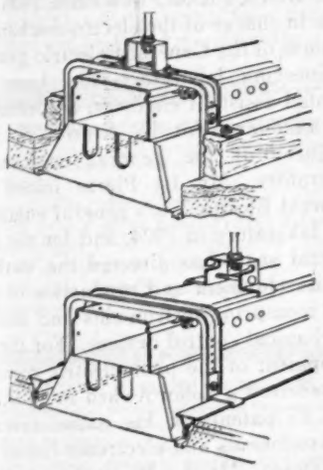
•

▶ BRAYTON D. FISHER has been appointed merchandise sales manager of the Narragansett Electric Co., Providence, R. I., having been sales manager of the Arlington (Mass.) Gas Light Co., another New England Power System affiliate, since 1934. He was born at Worcester, Mass., and was graduated from Norwich University in 1929. Before going to Arlington Mr. Fisher was a sales engineer with the Roberts Gordon Appliance Co., Buffalo, N. Y., and besides being engaged in the appliance business at Worcester was connected for a short time with the Cambridge (Mass.) Gas & Electric utilities. Wil-



... for the man who likes it straight from the shoulder!

THE MILLER TROFFER SIMPLIFIES FURRING



Miller Troffers can be hung directly from *structural* ceiling and, by means of patented Miller bracket, the *false* ceiling (either wood or metal frame) can be hung from Troffer. This greatly simplifies furring and adds to flexibility of installation.

We have just rounded out 100 years in the lighting business but we don't think about it that way. *We* figure we're just starting our *second* 100 years—with feet firmly braced on past experience and eyes on the future.

We believe — implicitly — that we have developed the best dawgonno continuous flourescent lighting systems the world has ever seen —seen BY—and seen BETTER by.

They have proved themselves, breaking lighting bottlenecks on our production front. By consistently delivering the goods, they have *earned* their place of foremost consideration in postwar planning of all kinds, including offices, stores and schools.

The Miller two-light Troffer, shown above* can be economically installed (recessed, flush or pendant) in almost any type ceiling. It is attractive—and practicable—in single units, combinations of units or continuous rows BY THE MILE. Its shallow dished panels offer a wide variety of designs. It is so versatile that its applications are almost as unlimited as the architect's ingenuity.

It is economical to service and encourages the benefical use of fully adequate lighting instead of eye-straining, pinch-penny methods.

As the huge wartime bulge in industrial lighting tapers off, new users of fluorescent lighting will fill the gap. Electric Utilities Companies can well encourage this healthy trend.

Miller Engineers are in principal cities and they are there to help lick lighting problems. So call in a Miller Engineer—or call us directly—and see what 100 well spent years have taught us.

**Shown now only for your advance planning.*

THE MILLER COMPANY • MERIDEN, CONNECTICUT

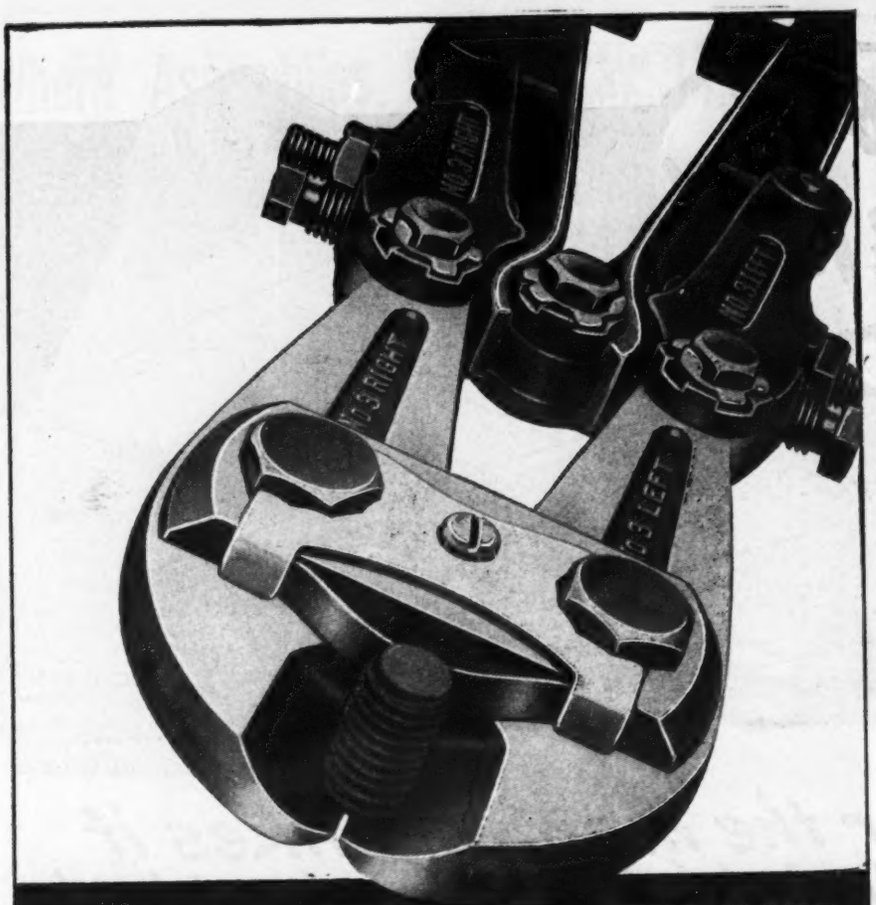
ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844



PORTER TWO-HAND CUTTERS

NO OTHER POWER REQUIRED

Porter cutters save time and labor whether used on repairs, construction, production, or in emergencies.

Rod, bolt, flat bar, cable, wire, and chain cutting; flush, overhead, on floor, etc., are only a few of the operations easily and quickly performed by hand with Porter standard cutters. Porter special tools for heading, pressing, crimping, punching, and caulking are equally efficient.

Write for Porter Catalog, illustrating and describing the Porter line — also a free copy of Tool Maintenance Book — a practical manual on the use and care of clippers, saws, chisels, files, and other hand tools. A request on post card or letterhead will bring it without charge.

H. K. PORTER, INC., 412 Ashland St., Everett 49, Mass.

PORTER HKP CUTTERS

LIAM M. FREUDIGMAN, formerly advertising manager of the Narragansett Electric Co., Providence, R. I., has been appointed assistant merchandise sales manager of that utility.

•

Proctor Electric Elects 3 New Vice-Presidents

Election of three new vice-presidents of the Proctor Electric Co. has recently been announced.

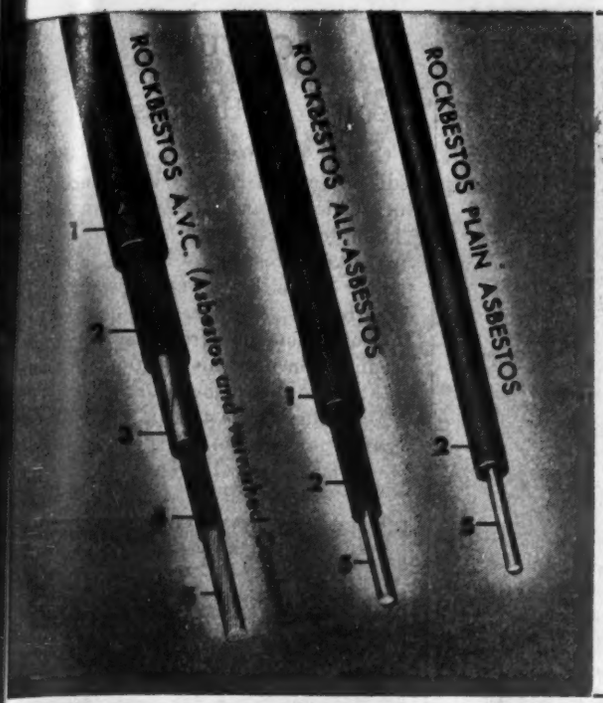
The new officers are R. M. Oliver, vice-president in charge of sales; A. H. Caesar, vice-president in charge of production, and H. F. Hild, vice-president in charge of engineering.

Mr. Oliver will direct all sales and advertising activities of the company. He has been serving as assistant general sales manager. Known as the "daddy" of the famous Proctor Swap Plan, Mr. Oliver originated this idea which has resulted in the sale of more than $10,000,000 in War Savings Stamps. The plan calls for turning in idle electrical appliances in return for stamps. Earlier in his career Mr. Oliver was associated with Bozell and Jacobs, Inc., advertising agency of Omaha; Iowa-Nebraska Light & Power Co., and Westinghouse Electric & Manufacturing Co.

•

► C. W. LA PIERRE, who since 1936 has been in charge of the electro-mechanical sections of the General Eelectric general engineering laboratory, has been appointed assistant engineer, according to an announcement by Everett S. Lee, engineer of the general engineering laboratory. Mr. La Pierre joined the General Electric Co.'s general engineering laboratory in 1924, and for the past several years has directed the work in the development and production of special measuring instruments and electro-mechanical control devices. For the development of the photoelectric recorder he received a Coffin Award in 1937. He has 15 patents in his name, covering measurements and electronic circuit applications. Mr. La Pierre is a member of the American Institute of Electrical Engineers.

► FRANK WILHELMS has joined the Edwin L. Wiegand Co., Pittsburgh, as assistant to the president. Mr. Wilhelms was formerly advertising promotion manager for the Pittsburgh Post-Gazette. Previously he had conducted his own advertising agency. His headquarters will be at the Pittsburgh plant and he will devote his attention to the promotion of Chromalox electric range units and electric heating units for industry.



3 GETS YOU 122

122 wires, cables and cords, stemming from the three basic designs illustrated, have been developed by Rockbestos to give trouble-free performance under severe operating conditions in steel mills, power plants, chemical industries, etc. Send for catalog to see the rest.

Rockbestos Permanent Insulation Insures Long-Lived Performance

1. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.
2. Felted asbestos insulation impregnated with heat-, flame-, and moisture-resisting compounds will not dry out, become hard and brittle, or burn. Also serves as a heat-barrier against high ambient temperatures.
3. Lubricated varnished cambric for high-dielectric strength and added moisture resistance, protected from heat, flame, and oxidation by felted asbestos walls.
4. Felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.
5. The conductor is perfectly centered in helically applied insulation and will always remain so.

600 VOLT A.V.C. SWITCHBOARD WIRE—TABLE B
(Underwriters' Type AVB)

Sizes No. 18 to 4/0 A. W. G. with varnished cambric and felted asbestos insulation and gray, black, white or colored flameproof cotton braid.

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is absolutely fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A. V. C. Hinge Cable and Switchboard Bus Cable have the same fireproof and heatproof characteristics.

INDUSTRIAL HEATING CABLE—TABLE LH

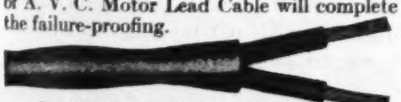
No. 19 A. W. G. nickel-chromium wire insulated with .040" of felted asbestos and covered with 4/64" waterproof lead sheath.

This pliable cable distributes a mild heat evenly over a large area. Prevents freezing of water pipes, wet pipe sprinkler systems, etc. Keeps conveyor pipes for fuel oil, soap, varnish, ink, chocolate, etc., at temperatures that insure steady flow.

ASBESTOS INSULATED MAGNET WIRE

Round, square and rectangular asbestos insulated conductors finished to meet varying winding conditions and coil treatment requirements.

Protect your motors against heat-induced breakdowns with class B windings of Rockbestos Heat-Resisting Magnet Wire. Leads of A. V. C. Motor Lead Cable will complete the failure-proofing.



ALL-ASBESTOS FLEXIBLE CORD—TABLE CA

Sizes No. 10 to 18 A. W. G. with two or three conductors insulated with felted asbestos, covered with asbestos braid. Also in A. V. C. (asbestos and varnished cambric) constructions.

This heat-resisting flexible cord is ideal for high-wattage lighting units, floodlights, blueprint machines, apparatus, etc., which require a heavy duty, enduring cord. For moisture-resistant construction specify the A. V. C. type. Labeled cord with polarized conductors if desired.

600 VOLT A.V.C. BOILER ROOM WIRE—TABLE C
(Underwriters' Type AVA)

Sizes No. 18 to 4/0 A. W. G. This construction for sizes 18 to 8, sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A. V. C. construction is ideal. Also for locomotive panel wiring and for switchboards requiring an asbestos braided wire.

THERMOSTAT CONTROL WIRE—TABLE TC

Sizes No. 14, 16 and 18 A. W. G. in two to six conductors with 12½, 25 or 31 mil wall of felted asbestos insulation and cadmium plated steel armor.

A multi-conductor control wire for low voltage intercommunicating, signal and temperature control systems. Its lifetime insulation and rugged steel armor will give you trouble-proof circuits.

600 VOLT ALL-ASBESTOS RHEOSTAT CABLE—TABLE R
(Underwriters' Type AI)

Sizes No. 18 A. W. G. to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this power and rheostat cable for wiring rheostats, switchboards, elevator and locomotive control panels and electrical equipment exposed to heat, fumes and fire hazard. Also for general open wiring in dry, high temperature locations. For solid conductor specify Rockbestos Rheostat Wire, Table A.

600 VOLT A.V.C. MOTOR LEAD CABLE—TABLE L
(Underwriters' Type AVA)

Sizes No. 18 A. W. G. to 1,000,000 CM insulated with two walls of felted asbestos and a high-dielectric, heat-sealed varnished cambric insert, covered with heavy asbestos braid.

Heatproof, fireproof, greaseproof and oilproof, will not dry out and crack, won't burn or carry flame, and remains permanently flexible. For coil connections, motor and transformer leads where extreme heat and fire hazards are encountered as in steel mills, etc.

600 VOLT A.V.C. CONTROL CABLE

In one to 19 conductors. Standard stranding A. W. G. No. 12—19/No. 25 and No. 9—19/No. 22. Other strandings furnished.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.

600 VOLT A.V.C. POWER CABLE—TABLE E
(Underwriters' Type AVA)

Sizes No. 18 A. W. G. to 1,000,000 CM insulated with laminated felted asbestos, varnished cambric, and asbestos braid. Other constructions for service voltages to 8000.

Recommended for power circuits and hot spot wiring in or around boiler rooms, steam tunnels, soaking pits, tenter frames, glass plants, etc. The asbestos and heat-sealed varnished cambric construction has ample moisture resistance and withstands high temperatures.

Rockbestos Products Corporation, 958 Nicoll Street, New Haven, Conn.

WON'T bake brittle, bloom, burn or rot—
RESISTS heat, moisture, oil, grease and fumes

ROCKBESTOS

The Wire with Permanent Insulation

SUB-ZERO GAS THAT
KILLS FIRE IN SECONDS *without damage*

Specifically, that swift, fire-smothering gas is carbon dioxide, the fastest non-damaging fire extinguishing agent known to man. Back of the gas is C-O-TWO Modern Fire Equipment which harnesses and controls the tremendous power of the sub-zero gas. Rugged equipment built for particular fire hazards, it is used to extinguish electrical, oil, gasoline, paint and flammable chemical fires. Whether your fire protection problem indicates smoke detecting apparatus, built-in-systems to protect one or more areas, portables or wheeled units, C-O-TWO Fire Equipment will give you the most modern carbon dioxide fire protection.

C-O-TWO

C-O-TWO Kills Fire—Saves Lives—It's Safer—It's Faster—It's Modern.

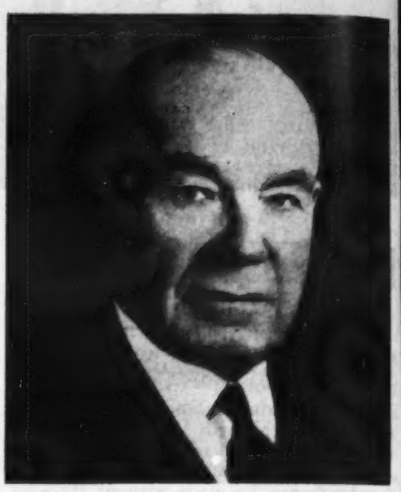
C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada
Affiliated with Pyrene Manufacturing Company

OBITUARY

George A. Hughes

George A. Hughes, chairman of the Edison General Electric Appliance Co., Inc., Chicago, and widely known as the "father of the electric range", died in St. Luke's Hospital, Chicago, on September 9, in his seventy-second year. Mr. Hughes served as president of the Hotpoint Company from the time of its organization until his election as chairman of the board in 1940.

Mr. Hughes started in business operating electric utility properties in Montana and the Dakotas. In 1910 he



went to Chicago where he made the first practical domestic electric range. Here he formed the Hughes Electric Heating Co. It was through his personal efforts that electric utilities at this time first became interested in electric cooking as a profitable domestic electric load. The present organization was formed in 1918 with Mr. Hughes as president.

Mr. Hughes was born in Monticello, Iowa, and was graduated from the University of Minnesota. Just prior to his election as Hotpoint chairman in 1940, Mr. Hughes was honored as a Modern Pioneer by the National Association of Manufacturers. Late that same year, on the thirtieth anniversary of the advent of the electric range, he was awarded the James H. McGraw Award manufacturers medal in recognition of "his long and arduous service to the electrical industry and his outstanding contribution to electrical manufacturing."

•

▶ GEORGE M. PIERCE, 44, Allentown division manager of the Pennsylvania Power & Light Co., died suddenly, August 28, at his Allentown home from a heart attack. Mr. Pierce joined P. P. & L. in December, 1920, as a time keeper for a former subsidiary, the Phoenix

FORMED INSUROK

AS THE STRUCTURAL STRENGTH WE'LL NEED"

The ability of Laminated NSUROK to meet structural ength requirements has startled ny a skeptical engineer. And *rmed* Laminated INSUROK, re- tly introduced for military use, quires even greater strength char- eristics, solves many product and ign problems for which ordi- y laminates prove inadequate. f your product or the one you are developing can be improved by the use of plastics with high structural strength, let a Richardson Plastician help you. Or, if resistance to chemicals, dielectric qualities, or moisture resistance is required, let him suggest the correct type and grade to meet your individual requirements. His years of experience may save you time and money. Write for complete information.

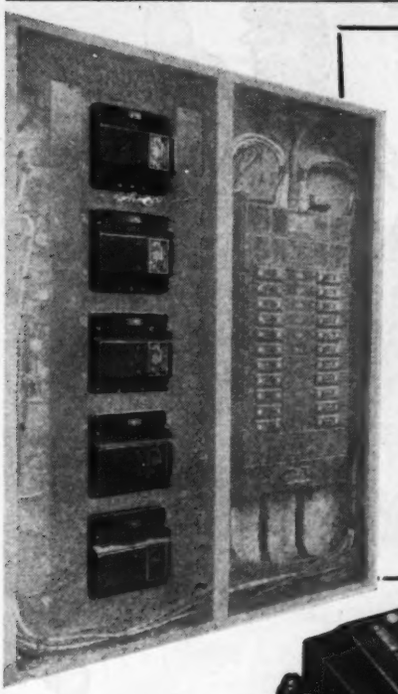
Laminated INSUROK has won the preference of many designers because of its favorable weight to strength ratio. Molded INSUROK is often preferred because of the intricate shapes which can be produced in one molding operation—eliminating assembly and manufacturing operations.

INSUROK *Precision Plastics*

The RICHARDSON COMPANY

MELROSE PARK, ILL. NEW BRUNSWICK, N. J. FOUNDED 1858 INDIANAPOLIS 1, IND. LOCKLAND, CINCINNATI 15, OHIO
DETROIT OFFICE 6-252 G. M. BUILDING, DETROIT 2, MICHIGAN NEW YORK OFFICE 75 WEST STREET, NEW YORK 6, N. Y.

The Makeup of *Outstanding* Panel Boards



The Plant

The Glenn L. Martin Company, Baltimore, Md.

The Panel Boards

Mfd. by Pringle Electric Manufacturing Company, Philadelphia, Pa.

The Remote Switches

ASCO Type RC, Bulletin 920

The Duty

Remote Control of all high-bay lighting from convenient control stations

THE immensity of the Martin Bomber Plant is no military secret. The lighting for this huge plant called for the best in engineering talent, the best in equipment and lots of it.

The Panel Boards are located to provide short branch circuits. ASCO Remote Control Switches are used for the desired grouping of branch circuits. Control stations at desired points are connected by pilot wires.

These ASCO Remote Control Switches provide (1) simplicity in wiring design, (2) convenience in control, eliminating waste in current, (3) economy in installation of straight feeders and short branches, (4) minimum line drop and line losses.

In this plant there are over 3,000 ASCO Type RC Remote Control Switches. Do they need further recommendation? Being selected for this important assignment is a tribute to their efficiency and reliability.

ASCO Electrically Operated SWITCHES — Include { AUTOMATIC TRANSFER SWITCHES, REMOTE CONTROL SWITCHES, CONTACTORS, RELAYS

We also manufacture a line of Solenoid Operated Valves for Automatic and Remote Control of Liquids and Gases

9-AS-6

Automatic Switch Co.

41-C East 11th Street, New York 3, N. Y.

Utility Co. He was made district manager of the company at Slatington in 1932 and in 1939 he was made head of the Allentown division.

•

Frank H. Reagan

Frank H. Reagan, chairman of the board of the Locke Insulator Corp., Baltimore, Md., died on September 10 in St. Agnes Hospital in that city after a short illness. He was 71 years of age.

Born in Corry, Pa., Mr. Reagan was educated in Pennsylvania public schools. He served as superintendent of motive power for the Delaware, Lackawanna & Western Railroad at Scranton, Pa., before joining the Locke Insulator Corp. in 1917, when its headquarters were in Victor, N. Y. In 1923 he was sent to Baltimore to supervise the erection of the present Locke Insulator plant in that city.

It was in 1923 that Mr. Reagan was elected president of Locke Insulator and in 1940 he became chairman of the board.

Mr. Reagan was a member of the National Electrical Manufacturers Association and of the American Ceramic Society.

•

▶ DONALD B. MACCLELLAN, 53, of the purchasing department of the Stone & Webster Engineering Corp., Boston, and an employee of the company since 1917, died at the Leonard Morse Hospital, Natick, Mass., on August 31.

▶ RAYMOND C. MONS, a district representative and field engineer of the Benjamin Electric Mfg. Co. in the Chicago area, died on August 19 at the age of 59. Mr. Mons was employed by the company in 1912 and had a record of 31 years of continuous service. He was widely known among electrical and maintenance men of Chicago industries and participated in Chicago Lighting Institute and I. E. S. activities.

•

▶ A. T. HUTCHINS, operating consultant for the five southern companies of the Commonwealth & Southern group, died on July 20. Just before his death, Mr. Hutchins was engaged in studies of new steam plant design problems as affected by operations. Mr. Hutchins frequently participated in meetings of representatives of operating companies for discussions on general or specific operating and maintenance problems relating to generating plants and transmission systems. Prior to his association with the Commonwealth & Southern Corp., he was affiliated with Alabama Power Co.

3 Practical Suggestions

TO HELP YOU GET THE JUMP ON POSTWAR LIGHTING SALES

1. **Remind** all your commercial customers *now by mail* that expert engineering advice on store lighting is at their service through you. All types of equipment will be offered them postwar . . . some good, some bad. When they consult you, they get competent recommendations for lighting units that will fit their needs best.

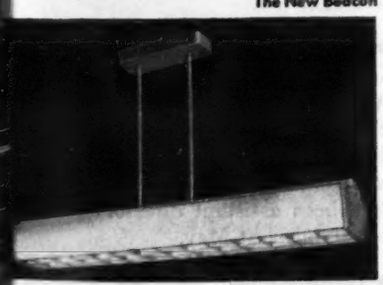
2. **See** that your people are posted—not only on lighting layout but on lighting sources, circuits, wiring and lighting engineering. That means training. Plan for it now.

3. **Set** a definite manpower goal for your lighting department. Here's the thinking of two different companies. One, serving a group of small to medium cities, plans on 1 lighting man to every 500 commercial meters. The other, serving a large city and surrounding communities, aims at 1 lighting man for every 2,000 meters. Naturally this will vary according to your own postwar operating setup. But plan now so you'll get the jump on tomorrow.

Sincerely,

A. F. Wakefield

The New Beacon



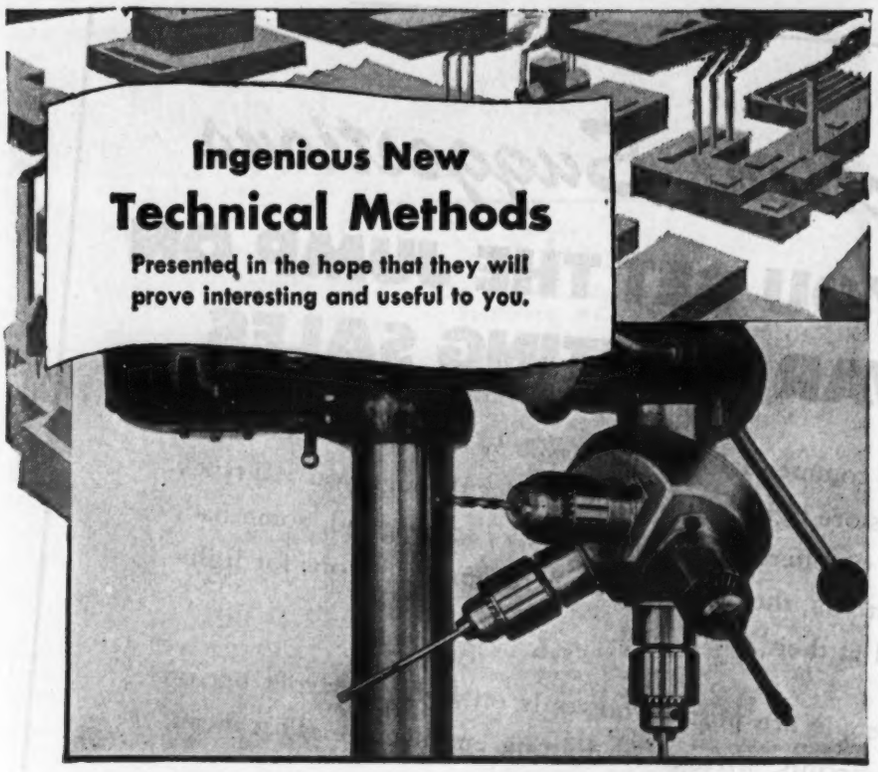
One way Wakefield can serve you

Wakefield lighting equipment is always engineered for top-notch performance. That's why Wakefield's policy now and postwar is to work with you for engineered lighting installations. Typical of the Wakefield fixtures that can help you provide good lighting for essential jobs now is the BEACON. Designed for high quality fluorescent at lower cost. Easy to maintain. Rigid louvers hinged for easy lamp replacement. Write for details.

THE F. W. **Wakefield** BRASS COMPANY

RED ● SPOT LIGHTING FOR WAR PRODUCTION . . . FOR PEACETIME FUTURE

VERMILION, OHIO



Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.

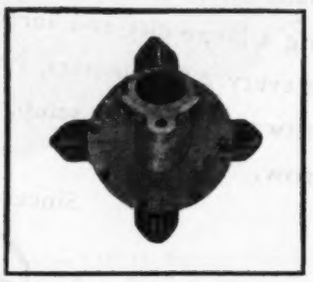
Amazing New Four Spindle Turret Attachment for Drill Press!

Now one drill press can do the work of four and, at the same time, effect a savings of up to 75% in floor space, with the "Quadrill" attachment. This rotary device will accommodate four boring or cutting tools at the same time, yet one tool *only* is in motion when the head is in operating position.

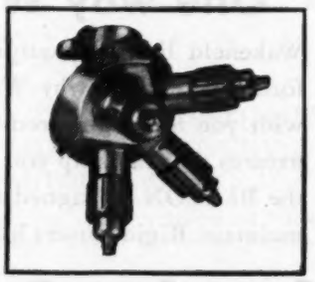
The entire unit is assembled to the quill of the drill press and is driven from the drill press spindle. Accuracy and rigidity of alignment of the "Quadrill" are assured by the special construction of the driver and spindles, thus efficiency is only limited by the accuracy and power of the drill press itself.

Foolproofing in indexing is accomplished by visual markings and by the relationship of the index pointers on the index disc, as well as the extension of the spring retainer. Four hardened and ground spindles are fitted for No. 32 Jacobs chucks or their equivalent. To provide correct positioning at all times, the entire spindle assembly is located by means of an accurate fitting of recess and undercut, between turret and bearing housings. The hardened friction starter and driver have been so constructed that at any speed proper synchronization of the driver teeth is accomplished without clashing.

It goes without saying that our fighting men must have the finest possible quality materials home industry can produce. So, although the stock of quality raw materials from which Wrigley's Spearmint chewing gum is made is growing steadily smaller, they are still maintaining pre-war standards. However, they can now make only a portion of their former output, so all of this limited production is going to our fighting men and women overseas only . . . where it is an "on-duty" need.



Quick and positive indexing assured by pointers on index disc



Quadrill assembly complete ready for attachment to drill press

You can get complete information from Chicago Drillet Corporation, 919 North Michigan Avenue, Chicago 11, Illinois.

Y-142

William A. Anderson

William A. Anderson, presid... the John A. Roebling's Sons C... Trenton, N. J., died at his hom... Princeton, N. J., on September 10... an illness of two months.

Entering the employ of the Roe... firm as a timekeeper, Mr. Ande... progressed steadily in the organiz... with which he remained throughou... career. He had been vice-presi... treasurer and general manager for... eral years when, in 1936, he was el... president of the company, succee... Ferdinand W. Roebling, Jr. He w... director of Otis Elevator Co.

Mr. Anderson was born in Tr... and spent five years, 1883-88, at... Lawrenceville School, then joi... Roebling. He was 74 years of ag...

•

▶ CLEM A. COPELAND, retired execu... of the Los Angeles Bureau of P... and Light, died on August 18 in L... Angeles at the age of 74. Mr. C... land attended Stanford Univers... took his master's degree at Cor... University and returned to Stanf... for post-graduate work. In 1900 ... was appointed head of the electri... engineering department at Stanfo... He went to Los Angeles in 1917 a... was named superintendent of resea... and records for the Bureau of Po... and Light, retiring from that positi... in 1940.

▶ J. L. LAWRENCE, traveling engine... for the Northern States Power Co., M... neapolis, Minn., died on August 15 fo... lowing a heart attack. He was 68 yea... of age and had been identified wi... Northern States organization for 3... years. Mr. Lawrence was born in Tr... boro, N. C. Early in his career he wa... associated with public utilities in th... eastern part of the country. Since 190... he had taken an active part in expand... ing and improving steam power plant... of the Northern States Power C... system.

▶ RALEIGH H. BARNES, assistant director... of research of the American Steel &... Wire Co., Cleveland, died suddenly on... September 2 in that city. Mr. Barnes... became identified with American Steel... as a laboratory assistant in 1920 and... had been assistant director of research... since only last May.

▶ GEORGE R. BROWN, superintendent of... manufacturing engineering at Western... Electric Co.'s plant at Kearny, N. J.,... died in Newark, N. J., on September ... after suffering a heart attack the pre... ceding day at his summer home in Cran... berry Lake, N. J. He was 49 years of... age.

JUST PUBLISHED BY McGRAW-HILL

DEWEY

An American of This Century

by STANLEY WALKER

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3. The Beginnings
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5. Mr. Medalie Finds a Champion
6. Special Prosecutor
7. The Liberation of a City
8. The Honest Blacksmith
9. Mr. District Attorney
10. The Forlorn Hope
11. Defeat in Philadelphia
12. Interlude
13. Landslide
14. The New Broom
15. Wards of the State
16. Workmen's Compensation
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A full-length, authoritative, highly readable study of the Republican candidate, written by a veteran newspaperman. Here is the amazing record of the G. O. P.'s fighting standard-bearer . . . here are his principles and beliefs . . . here we see him at work and at play, in struggle and triumph. Supplemented by 45,000 words of excerpts from Dewey's major speeches and statements. $2.50.

Really *know* this candidate

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MANUFACTURING MARKETS

G.E. Plans New Center for Electronics Dept.

Announcement that General Electric had purchased a 155-acre plot of ground, in Liverpool, five miles from the city of Syracuse, N. Y., and planned, when necessary materials are released by the government, to build a new plant and make it the headquarters for the company's electronics department, was made by Gerard Swope, president, at a Chamber of Commerce dinner held recently in Syracuse.

Although definite plans for the proposed plant have not been made, preliminary arrangements call for the erection of several buildings so landscaped that it has already been suggested the plant be called "Electronics Park."

The announcement was made before 250 of Syracuse's leading business men. "I don't want you folks to get the mistaken impression that we are going to build that plant tomorrow," Mr. Swope said. "We couldn't, if we wished to. But we are serious in our intention of making this the headquarters of our electronics department, to make the various equipment here that we are making today and hope to make in the future."

W. R. G. Baker, vice-president in charge of the electronics department, followed Mr. Swope with an explanation of electronics and what the future might be in this new development. "We do not know, of course, how much electronic business will amount to in the United States," Dr. Baker said. "However, one measurement is that the total potential based on present knowledge this year will be approximately $4,000,000,000. Of course, this can not be obtained after the war but it is possible that at least there will be two billion during peacetime."

•

Open Navy Service Shop

To repair battle-damaged equipment and to handle general maintenance requirements for the Navy, General Electric Co. planned to open a service shop in San Diego, Calif., early in September. Ralph Meyers, former superintending engineer for General Electric at Marinship Corp. on San Francisco Bay, is manager of the new installation. Because of the urgent need for repair facilities for ships entering San Diego harbor, the Navy has assisted General Electric in procuring equipment and manpower, it was announced by H. A. Cordes, local company manager.

•

Job Possibility Survey Started by Emerson

With a view to expediting civilian employment of thousands of demobilized technicians of the Army Signal Corps and Naval Communications, and other radio-electronics specialists in the armed services, Emerson Radio & Phonograph Corp. has begun a nation-wide survey of twenty thousand dealers to determine, as nearly as possible, the future personnel needs of retailers and distributors in the radio and allied industries.

Results of the survey will be made available to governmental agencies and veterans' organizations concerned with re-employment.

GIANT BREAKER FOR COULEE—Capable of interrupting 3½ million kva., this oil circuit breaker for Grand Coulee has the greatest interrupting capacity of any 230 kva. breaker ever built. It will interrupt fault currents as high as 8,800 amperes in 1/20th of a second. By skillful design, dimensions have been reduced to a point where this breaker is no larger physically than 230 kv. breakers of only 2½ million kva. interrupting capacity. The breaker is shown being set up for its final test at the Westinghouse factory

Will Develop Glass Television Bulb

To develop glassware for use in te vision bulbs and machinery to ma facture them in large quantities, t Corning Glass Works has established new department.

As a result of a survey of televisi tube manufacturers, Corning Glass convinced that glass tubes can standardized, a development which t war has prevented, and mass produ tion made possible. Leading manufa turers have already indicated their terest in a flat-faced 10-inch diamet lead glass bulb for medium-priced rect-viewing television receivers.

It is estimated that perhaps a milli or more television receivers will be s in the first post-war year. Assumi 300 watts as the requirement of a ceiver, television promises some 300,0 to 500,000 kw. of load for electric supply systems in that first year w a heavier demand to follow.

•

F-M Purchases Hendy Iron Works Un

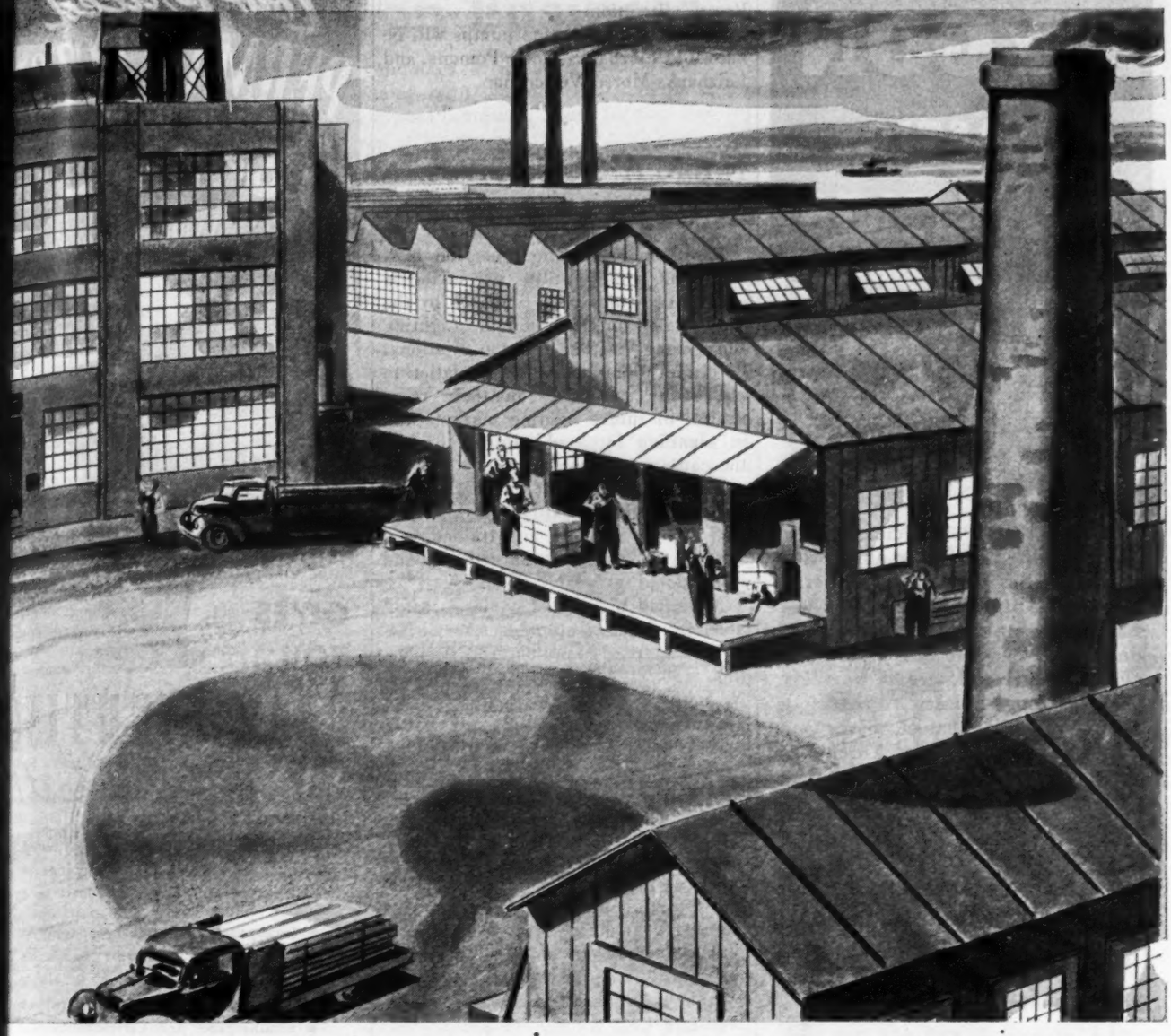
Fairbanks, Morse & Co. has p chased the Pomona Pump Co., a divis of Joshua Hendy Iron Works in $4,000,000 transaction.

Announcements of the sale w made simultaneously in Chicago by H. Morse, Jr., general sales manag of Fairbanks-Morse, and in Sunnyva Calif., by Charles E. Moore, presid of the Joshua Hendy Co. The sale w effective as of September 2.

All physical assets, patents and tra marks of the Pomona and Westco pu lines were included in the transacti

No changes in personnel are conte plated and, according to Mr. Mor Arnold G. Brown, general sales ma ager of the Pomona company, becom assistant manager of the Fairban Morse pump division in charge of P mona and Westco products. Distri

NUMBER 12 IN A SERIES OF MESSAGES BY KELLETT AIRCRAFT CORPORATION ★



THERE'S SOMETHING IN THE AIR . . .

THE SHADOWS of slowly descending helicopters will be a frequent sight in the peacetime years to come . . . but only after the war will you learn *all* of the progress in design and the engineering improvements that have *already* taken place. Today's "in the air" performance of several successful helicopter types is known only to the Military Services . . . but in the tomorrows to come it is likely that the ability of helicopters to land and take off vertically . . . to fly rapidly or hover in the air . . . will find many commercial, personal and industrial uses. The patrolling of forest areas and ranches, the inspection of cross-country power and pipe lines, spraying crops, servicing inaccessible places far from airports, are just a few of many useful applications of the helicopter. Kellett's expanding engineering staff looks with anticipation to the future . . . when modern helicopters will bring you one of the most progressive developments to come out of this war. Kellett Aircraft Corporation, Upper Darby (Philadelphia), Pa.

KELLETT

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY

TYGON
PLASTIC
COATINGS

Resist
WATER, OIL
ACIDS
GASOLINE
ALCOHOLS

● Tygon TP-81* is a clear plastic coating with low water absorption characteristics and high dielectric strength. Applied by dip, spray or brush, it provides effective and durable insulation and protection against water, oil, grease or acids. Forms a tough, elastic, impervious skin over copper, steel, silver and other metal surfaces. Does not become brittle with age.

* For certain applications the use of Tygon Primer with Tygon TP-81 is required to develop maximum adhesion.

● High Dielectric Strength
● Low Power Factor Loss
● Tough and Elastic
● Non-oxidizing
● Non-flammable

WRITE FOR TEST PANEL TODAY!

Tygon Plastic Coatings are also available in white, black, gray, green and red, and in formulations for impregnation of porous materials.

U. S. STONEWARE
Since 1865
AKRON, OHIO
MANUFACTURERS OF CORROSION-RESISTANT MATERIALS AND EQUIPMENT

tion and sales will continue under Mr. Brown's direction.

Hereafter the Pomona pumps will be known as Fairbanks-Morse-Pomona, and Fairbanks-Morse-Westco line.

•

N.E.M.A. Book Gives Light Market Study

Based on information received in a survey of public utility executives, a sales manual has been prepared by the Industrial and Commercial Lighting Equipment Section of the National Electrical Manufacturers Association to aid utility executives in their reappraisal of future lighting markets and in planning for load-building through the capture of these markets.

The book points out the markets for improved lighting, explains how a sales staff can be built up and trained, and suggests a practical advertising and promotional program.

A limited number of copies is available from the section secretary, National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N. Y.

•

Westinghouse Prepares Course in Electronics

Designed to give in a clear manner the basic principles and applications of electronics in industry, a new ten-part training course covered by sound slide films, lesson books, quiz books, and an instructor's manual has been prepared by the Westinghouse Electric & Manufacturing Co.

Although designed primarily for Westinghouse employees, the material has been made available to others at reproduction costs because of many requests from engineering groups and individuals interested in electronics.

Sound slide films and records for the ten lessons give clear, visual explanations of basic theory and applications. Information booklets on industrial electronic equipment are supplied.

•

Permits Vacuum Cleaners

Electrolux Corp., under the so-called "spot" authorization plan, has received from the War Production Board permission to produce in its New York City plant a limited quantity of new domestic vacuum cleaners from materials, facilities and manpower on hand, on a temporary basis until the end of the year, according to Lewis S. Greenleaf, Jr., WPB regional director.

Low Priced
PERMAFLECTOR
200 WATT
FLOODLIGHT

ST-200
For
200-WATT
INCANDESCE

GIVES YOU...
PEAK LIGHTING
at new low cost!

● Projects a full pattern of light on an area of 2500 sq. ft., at a distance of 50 ft.

● Incorporates features found only in larger, higher-priced floodlights ● rugged in construction ● highly resistant to shock and vibration ● weatherproof and corrosion-resistant ● equipped with famous silver-mirrored glass Permaflector ● steel protective housing ● heat-resisting lens, (easily removable for maintenance.)

● Height, 12½"; length, 11¼", lens, 8⅛" in diameter. Floodlight is easily, quickly positioned to direct the light where wanted—250° swing vertically, 360° horizontally. For shovels, cranes, tractors; or mounting on posts or buildings. Low in cost. Inquire of your jobber or write direct for folder.

PITTSBURGH REFLECTOR CO
OLIVER BLDG., PITTSBURGH, PA.

ILLUMINATING ENGINEERS • DESIGNERS • MANUFACTURERS OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

Field Reports on Business

roduction of war materials is being maintained at a steady pace, though utbacks and cancellations are having some effect. Demand by the Navy for a ide variety of electrical equipment and supplies continues. Plans for post-war levision and FM service are moving ahead.

CHICAGO

xcept for a dropping off in the number building contracts awarded, Chicago's iness changes during the past twelve nths have continued their upward climb. nparison of indexes for July, 1943, and 4 show factory payrolls up 11.4 percent, artment store sales up 11.7 percent, out- ng telephone toll calls up 7.2 percent, ctrical power production up 0.7 percent building contracts awarded (number) off 10.7 percent.

Construction projects included in the in- trial developments of the Chicago area ring August, however, totaled $4,571,500, nging the figure for the eight months of year to $58,042,916 and to $1,038,937,- for the four-year period of the war and ense programs beginning July 1940.

The first half of 1944 saw orders for 438,355,000 worth of army weapons and er ordnance equipment placed by the icago Ordnance District of the Army. ntracts placed in June totaled $496,393,- a new high since March 1942 and nging the total for the second quarter of year to $847,497,000.

Chicago Flexible Shaft Co. will build a ge plant in Chicago for the production heat treating furnaces. The new plant l be located adjacent to the site of the npany's present plant.

On the utility front, Otter Tail Power Co., rgus Falls, Minn., plans new 60 mile- nsmission line, to connect a power sta- n with the transmission system. In braska, Loup River Public Power Dis- t, Columbus, has plans under way for tensions in primary and secondary lines different parts of territory, including wer substations and other operating ilities to serve new customers. Cost is orted to be about $1,000,000. Work is begin late this year or early next year, cording to plan.

NEW ENGLAND

New Bedford (Mass.) Gas & Edison Light is seeking governmental authority to d a 25,000-kw., 850 psi., 900-deg. con- nsing steam turbine unit with boiler uipment at its Cannon Street station.

w England production of war materials being maintained at a steady rate with s than 50 plants in this area behind ir production schedules on account of npower shortages. Bidding on small lots electrical equipment and supplies for the vy is active, and plans for post-war ex- nsion in practically all broadcasting radio tions in this area which include tele- ion and FM service are moving ahead.

Danbury (Conn.) Rubber Co. has re- ved a DPC contract amounting to $80,000 be used for additional plant equipment; er allotments awarded include $60,000 American Bosch Corp., Springfield, ss., for additions to Massachusetts and ode Island plants. Fifty community food eze lockers will be installed in Maine as on as materials are available. Post-war nversion plans are receiving intensive dy at the East Springfield (Mass.) plant Westinghouse Electric. Electric refrigera- n units will be produced in volume. Vice- esident J. H. Ashbaugh stated last week that substantially every machine tool in the plant will eventually have to be relocated for peace-time production, including ex- panded operations.

Massachusetts manufacturers of resistors and radio parts are very busy filling Navy orders. Bidding was active on motors up to 10 hp., electric food conveyors, centrifuges, capacitors, insulating materials, small panel boards and accessories, and radio appara- tus, including loud speakers and filter con- densers.

NEW YORK

With the termination of the war in Eu- rope approaching, accent at the present time is on readjustment to a peace-time economy.

Civil engineering construction volume for the short week due to the Labor Day holi- day totalled $25,369,000. This volume, not including the construction by military engi- neers abroad, American contracts outside the country, and shipbuilding, was 31 per- cent lower than in the corresponding 1943 week, and compared with $60,282,000 for the full preceding week as reported to En- gineering News-Record. Private construc- tion for the week was down 58 percent, com- pared with a year ago, and public construc- tion was down 25 percent as a result of the 32 percent decline in federal work. State and municipal volume was 69 percent above the 1943 week. The week's construction brought 1944 volume to $1,287,011,000 for the 36-week period, a decrease of 45 percent from the $2,322,368,000 reported in 1943.

New bonds tentatively scheduled for offering this month alone exceed $500 mil- lion. October may produce an equally large volume, if all the new issues now planned materialize.

Cooler weather combined with "back-to- school" purchasing resulted in a gain of about 20 percent in retail sales over the like 1943 week, department store executives in the Metropolitan area reported.

PACIFIC COAST

Government construction continues in good volume along the Pacific Coast be- cause of the increasing tempo of the Japa- nese war.

Recent new major work includes a $5,- 324,348 low bid for magazines and ware- houses in rehabilitated Port Chicago; $1,000,000 allotted for permanent facilities for Benicia Arsenal; a $1,157,000 award for Alameda naval air station, of which a considerable share covers electric utilities; a low bid of $2,681,122 for naval magazines at Bangor, Wash., including an extensive electrical protective equipment and a $1,- 996,000 naval ward for Lakeview, Wash.

Other orders cover five 25-ton drydock cranes, costing $630,750 for Pearl Harbor; $25,000 of metalclad switchgear equipment for Treasure Island overhaul; four 6000 hp. motors and exciter sets for Kaiser's shell case addition at Fontana.

Bonneville system is buying a 1,000 kva. transformer; Los Angeles is tripling its present airport acreage by adding to 10,000 foot runways with consequently heavy pur- chases in sight for an elaborate lighting system.

The SMALL BOLT in the Fargo Connector cuts friction to a minimum, tightens the tap in smooth, easy turns. Clean, precisely machined threads in both the bolt and connector body further assure easy, friction-free turning and high pressure contact at low torque. And remember, you can count on a Fargo to "grip like a vise" even after years of repeat use on the line.

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Distributed by

LINE MATERIAL CO.

MILWAUKEE • WISCONSIN

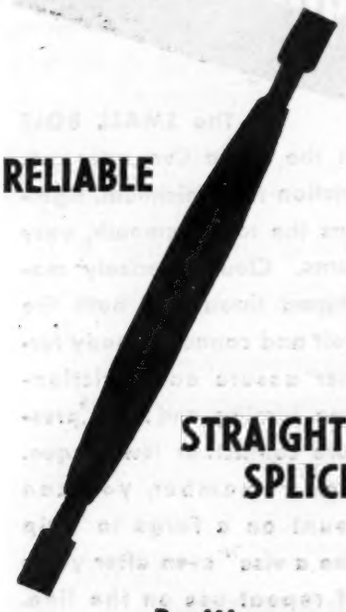
RELIABLE CAN HELP YOU

SAVE TIME

in speeding the war program by using Reliable Straightline splices on new construction and on maintenance.

SAVE COPPER

by using these perfect joint making units over and over again.



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Low in Cost

Reliable
ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES
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Sales Opportunities

OKLAHOMA—Public Service Co. of Oklahoma, Tulsa, has plans under way for a post-war expansion and improvement program to cost approximately $3,300,000. Of this amount, about $1,250,000 will be expended for extensions in steam-electric generating stations, including installation of additional equipment for increased capacity. Extensions will be made in transmission lines with additions to power substations and other operating facilities, estimated to cost about $825,000. Distribution lines to cost approximately $860,000, including service connections and other distribution facilities.

CALIFORNIA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has plans maturing for new material and distribution center; tract of about 150 acres of land recently was acquired. Work will comprise a number of shops, warehouses and other structures, totaling about 1,000,000 sq. ft. floor space, to be given over largely to salvaging of radio and electronic apparatus from damaged war vessels and airplanes in Pacific area. A power substation is planned, with electrical distribution system. Entire project is estimated to cost about $5,000,000, with mechanical and electrical equipment. It will be carried out under direction of Officer in Charge of Construction, Roosevelt Base, Terminal Island, Los Angeles.

MARYLAND—United Distillers of America, Ltd., 2700 Wilcomrico Ave., Baltimore, now in production for commercial alcohol for government, will carry out expansion in plant, including new by-products recovery unit for high protein cattle feed, estimated to cost about $365,000, with machinery and electrical equipment. Financing by Defense Plant Corp. Proposed to begin work soon.

VIRGINIA—National Advisory Committee for Aeronautics, 1500 New Hampshire Ave., N.W., Washington, D. C., plans expansion at Langley Field; new laboratories, new electrical building and electrical utilities, new motor-drive for wind tunnels. Cost estimated about $8,804,000. Additional fund of $534,351 being arranged for equipment for Langley memorial aero laboratory, including motor-generator sets, recording instruments, motors, and other electrical and mechanical apparatus.

WASHINGTON—Civil Aeronautics Administration, Constitution Ave. and 14th St., N.W., Washington, D. C., has rejected bids recently received for installation of lighting system at airport, and plans to award contract on a negotiated basis at early date.

OKLAHOMA—B. F. Goodrich Co., 500 South Main St., Akron, Ohio, has contracted with government for new rubber mill. Machinery and electrical equipment installation will cost about $500,000, with financing provided by Defense Plant Corp. Project will be carried out at early date.

LOUISIANA—Board of Commissioners, Fire Department, New Court House, New Orleans, plans installation of a new fire alarm system in different parts of city as a post-war project, estimated to cost about $2,583,000, with central station and other operating facilities.

CALIFORNIA—War Department, Washington, D. C., has authorized expansion at airfield, including new hangar, shops and other structures, with mechanical and electrical equipment. Cost estimated about $1,000,000. Project will be supervised by U. S. District Engineer Office, San Francisco.

MICHIGAN—Department of Light and Power, Marquette, plans installation of motor-operated ventilating equipment municipal diesel-electric power station, and bids will be asked at once.

IOWA—Light and Power Department, Duncombe, plans extensions and improvements in municipal power station as a post-war project, with installation of additional equipment for increased capacity. It is proposed to hold a special election on or about Sept. 28 to approve bonds for program.

PENNSYLVANIA—William Sellers & Co., Inc., 1600 Hamilton St., Philadelphia, manufacturer of machine tools, will carry out expansion in plant for production for government, with machinery and electrical equipment for increased capacity. Cost estimated at $285,000, with financing by Defense Plant Corp. Work will proceed at once.

TEXAS—U. S. District Engineer Office, Fort Sam Houston, San Antonio, plans early call for bids for installation of lighting on airfield, including permanent electric lighting facilities for taxiways and other service. (Specifications 1167).

WASHINGTON—Bonneville Power Administration, Department of Interior, 811 N.E. Oregon St., Portland, Ore., has plans maturing for new 230,000-volt steel tower transmission line about 54 mi. A new switching station will be built and extensions made to substation, with installation of transformers, switchgear and auxiliary equipment. Entire project is estimated to cost about $2,670,000. A priority rating has been secured and work is scheduled to begin at early date.

TEXAS—Doctor Pepper Co., 429 Second St., Dallas, manufacturer of soft drinks, plans new bottling plant on tract of about 20 acres of land, recently acquired, to consist of a group of one-story buildings for general production, storage and distribution. Equipment will be electrically operated. Entire project is reported to cost about $500,000.

WASHINGTON—Bureau of Reclamation, Denver, Colo., has postponed bids from Sept. 20 to Oct. 2 for miter gate operating mechanism (Specifications 1764-D); and for caisson hoists, barge hoists and auxiliary hoists (Specifications 1763-D) for Grand Coulee Dam, Columbia Basin project, previously noted.

GEORGIA—Crown Cork & Seal Co., Inc., Eastern and Cresson Aves., Baltimore, Md., manufacturer of metal bottle caps and closures, capping machinery and parts, has acquired tract of about 27 acres of land and will use as site for new plant, to be carried out as a post-war project. It will comprise several one-story buildings, with machinery and electrical equipment for large capacity. No official estimate of cost as yet announced. David G. Bloom is vice president.

MINNESOTA—Dakota County Electric Co-operative, Farmington, has plans under way for new power substation in connection with line extensions, and proposes to ask bids at early date. Entire project will cost about $100,000. Financing has been arranged through federal aid.

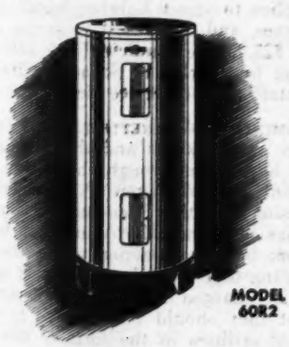
a LOAD BUILDER *for* TOMORROW'S JOB

Faced with a definite post-war domestic loadbuilding task, Public Utilities are wisely facing the problem today. In selecting loadbuilding appliances—look to Electromaster water heaters to help do tomorrow's job.

The Electromaster water heater and, yes—the Electromaster range—have pre-war loadbuilding reputations. In post-war days they can again be a real factor in your loadbuilding program.

ELECTROMASTER WATER HEATERS

Will be available in thirty, forty, fifty, eighty and one hundred-ten gallon capacity when production is resumed. Electromaster water heaters combine neat appearance with service-free operating efficiency.



ELECTROMASTER INC.
DETROIT 31, MICHIGAN

Tops in Protection

The spectacular production job America is doing is one of the miracles of all time.

TRICO "Powder-Packed" Renewable Fuses and KLIPLOK CLAMPS are contributing a full measure in the drive for producing much more — faster — better — and at LESS COST. The choice of discriminating engineers everywhere because they deliver top-notch efficiency and dependability. You get THREE TIMES THE SERVICE and protect production schedules against unnecessary stoppages.

TRICO KLIPLOKS
"Lock Like a Vise"

You get pressure contact between fuses and clips. The destroying temperatures that cause fuse clips to lose their tension — fuses to become destroyed and blow prematurely — delays and costly repairs, etc., disappear the moment KLIPLOKS are applied. KLIPLOKS are truely a dividend-paying investment.

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In Canada: IRVING SMITH LIMITED, Montreal

GOLD SEAL has everything you want in friction tape. Always fresh . . . always uniform. Tears evenly . . . wraps without welting or bulging. Won't peel, ravel, or smear up your hands. Above all – it sticks to the job!

Say **GOLD SEAL**, and a good supply house near you will come right up with the tackiest tape you ever saw . . . made by the makers of Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications. Jenkins Bros., 80 White St., New York 13, N. Y.

JENKINS *Gold Seal Tapes*
FRICTION • • RUBBER

Yes, BLACKBURN CONNECTORS are the strongest and most durable connectors on the market because they are the only connectors made of Duronze. And Duronze is a high-strength silicon bronze which tests show is up to 35% stronger than ordinary steel, and more non-corrosive than pure copper! Hence, BLACKBURN CONNECTORS will not distort, are trouble-free on the lines, and can be used over and over again. For real economy, it's BLACKBURN!

Millions in use throughout the world

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Over 100 Conveniently-located Jobbers' Stocks

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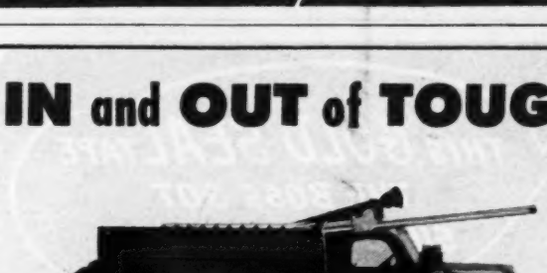
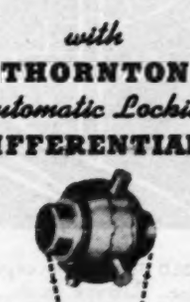
Builders of Quality Connectors for Over 10 Years

BLACKBURN CONNECTORS

IN and OUT of TOUGH SPOTS



NO WHEEL SPIN!
with
THORNTON
Automatic Locking
DIFFERENTIALS



Trucks that must travel across fields, ditches . . . through deep sand, mud, snow and over ice need this *Automatic* DIFFERENTIAL.

Spinning of one wheel, which normally stalls a vehicle, seldom occurs when this THORNTON DIFFERENTIAL is installed . . . because *both* wheels *must* rotate when power is applied.

For traction and action, investigate features and advantages. **Send for full details today.**

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Make Big Trucks Out of Little Ones with the THORNTON *Four-Rear-Wheel* DRIVE

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Recent Rate Rulings

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COAST COUNTIES GAS & ELECTRIC CO. of Santa Cruz, Calif., and the California Railroad Commission have reached a tentative agreement under terms of which the utility will reduce its charges to domestic and commercial consumers by an estimated $500,000 annually. Under the plan outlined at a rate hearing held recently in San Francisco the reduction would be effected through discounts to apply above present minimum charges. Commission officials testified that of proposed $500,000 reduction, $399,894 would be excess profits tax. Under the new rate set-up, which would become effective October 1 and continue through six months after close of war, excess profits tax would be wiped out.

WISCONSIN PUBLIC SERVICE COMMISSION has announced that rates for public utility service in Wisconsin were reduced more than $415.000 a year during the first six months of 1944. Electric utilities showed the greatest rate cut, $324.486 for about 88,000 customers, the commission stated.

PACIFIC POWER & LIGHT CO. has been authorized by the Washington Public Service Department to reduce its rates for municipal street lighting service in Yakima, Walla Walla and other communities in southeastern Washington. The rate reduction applies to street lighting installations of all types, and will result in annual savings of $25,000 to municipalities affected, according to Charles F. Schaefer, director of the state public service department.

MENOMINEE & MARINETTE LIGHT & TRACTION CO. rate charges and those of other utilities have been brought before the attention of the Michigan Public Service Commission by the Menominee Council which has petitioned the commission for a reduction, basing its action on the recent court ruling that federal excess profit taxes cannot be charged as operating expenses, and that they should be returned to customers of utilities in the form of rate reduction. Alderman Burke, voting for the reduction, said that the city should advise local utilities of the planned action "as a matter of courtesy."

KENTUCKY-WEST VIRGINIA POWER CO. proposed to lower rural electric rates $10,500 a year as it recently sought permission from the Kentucky Public Service Commis-

…n to construct 1,186 miles of new rural …es in 16 counties of east Kentucky.

CONNECTICUT POWER CO.'s rate schedule, …oviding for the sale of electric energy to …orrington Electric Light Co. for resale … the latter in Torrington, Conn., and vi…nity, has been suspended by the Federal …ower Commission. FPC has set a public …aring concerning the lawfulness of the …roposed increased rates for December 5. …he order stated that the schedule filed by …onnecticut Power Co. on August 4, to sup…sede the one now in effect, may result in …xcessive rates or charges to Torrington …d may place an undue burden upon ulti…ate consumers of electric energy; may be …scriminatory, and will result in increased …tes or charges which have not been …own to be justified."

VIRGINIA ELECTRIC & POWER CO. custom…s in the Virginia area formerly served by …irginia Public Service Co. will save ap…roximately $360,000 yearly under the rate …hedules which became effective July 17.

•

…ylvania Will Save 57 Acres of Paperboard

Sylvania Electric Products, Inc., will …chieve an estimated saving of 2,500,000 …q.ft. of corrugated paperboard in 1944 …n a single department of its Ipswich, …lass., factory, as a result of a 6-in. …eduction in the depth of shipping car…ons for fluorescent lamp fixtures. These …artons normally run from 50 to 52 in. …n length and their widths vary around … to 4 in., according to the number and …haracter of fixture units inclosed. A …tudy of this packaging showed that the …epth could be cut as above indicated …ithout reducing the capacity of the car…ons. On the average the reduction to …½ in. depth means from 29 sq. ft. per …ackage to 21 sq. ft. Handling and …toring of packages is much facilitated …y this change.

•

…dds to Sales Force

The Foxboro Co. has announced the …ddition of Paul Torre to the staff of …ales engineers covering the New Eng…land territory. His headquarters will be …t the New England district office of The Foxboro Co. at Foxboro, Mass.

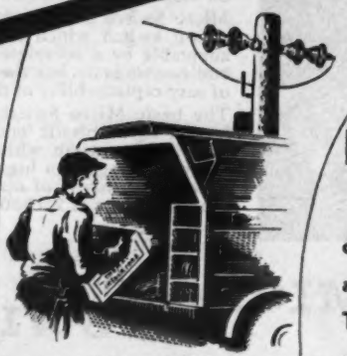
•

Expands Western Office

For more efficient handling of the …ever-increasing ventilation business on …he West Coast, Ilg Electric Ventilat…ing Co., Chicago, has moved its San Francisco branch office to larger head…quarters at 826 Sharon Building, 55 New Montgomery St., San Francisco 5, Calif. James S. Rose, formerly super…visory methods engineer in charge of heating and ventilation, Curtiss-Wright Co., Buffalo, N. Y., has been made manager of the new branch office.

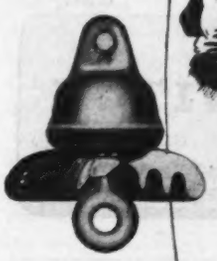
From Warehouse to Pole
NO RATTLE BREAK or ROLL

• Thomas "Pakt-To-Stack" cartons save space in your storeroom, may be stacked easily and safely. Each is legibly marked for quick identification and safely sealed against contamination.



THOMAS INSULATORS

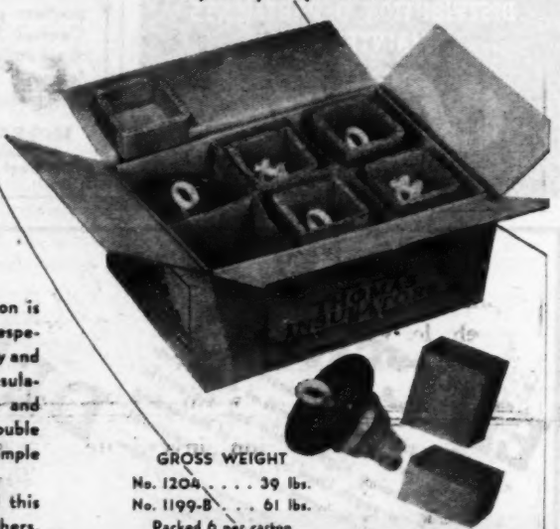
• Here's a strong new carton designed especially for Thomas 6" and 7½" diameter strain insulators. This carton is now our standard package for all units except hook-stud. Users have found there's real economy in buying their porcelain insulator requirements this "Pakt-To-Stack" way. The carton itself is light in weight, but rigid, strong and durable, guaranteeing safer and speedier handling with no breakage—all of which means lower construction costs when you specify "Thomas."



No. 1204
10,000 lb. M. & E. Rating
6" "Standard" Design

• Thomas "Pakt-To-Stack" cartons assure quicker delivery to construction crews by simplifying handling. Linemen like the lighter weight carton, find it withstands extremely rough handling and speeds construction.

No. 1199-B
15,000 lb. M. & E. Rating
7½" "Standard" Design



• The Thomas "Pakt-To-Stack" carton is made of strong fibreboard and is especially designed for maximum durability and protection to the insulator. Each insulator unit fits snugly into a separate and heavy fibreboard compartment. Double sides to the carton afford more than ample protection assuring safe delivery. Thomas Porcelain Insulators packed this modern way cost you no more than others.

GROSS WEIGHT
No. 1204 . . . . 39 lbs.
No. 1199-B . . . 61 lbs.
Packed 6 per carton

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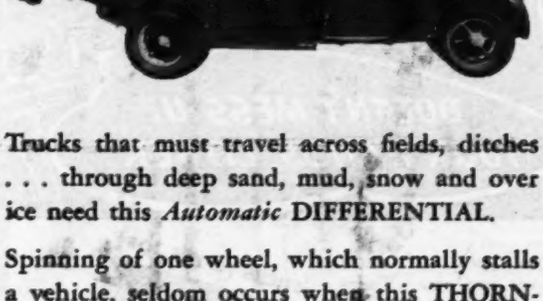

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KENTUCKY-WEST VIRGINIA POWER CO. proposed to lower rural electric rates $18,500 a year as it recently sought permission from the Kentucky Public Service Commis-

n to construct 1,186 miles of new rural es in 16 counties of east Kentucky.

Connecticut Power Co.'s rate schedule, oviding for the sale of electric energy to rrington Electric Light Co. for resale the latter in Torrington, Conn., and vi- nity, has been suspended by the Federal wer Commission. FPC has set a public aring concerning the lawfulness of the oposed increased rates for December 5. e order stated that the schedule filed by nnecticut Power Co. on August 4, to sup- sede the one now in effect, may result in xcessive rates or charges to Torrington d may place an undue burden upon ulti- te consumers of electric energy; may be criminatory, and will result in increased tes or charges which have not been own to be justified."

Virginia Electric & Power Co. custom- s in the Virginia area formerly served by irginia Public Service Co. will save ap- oximately $360,000 yearly under the rate chedules which became effective July 17.

•

Sylvania Will Save 57 Acres of Paperboard

Sylvania Electric Products, Inc., will chieve an estimated saving of 2,500,000 q.ft. of corrugated paperboard in 1944 a single department of its Ipswich, Mass., factory, as a result of a 6-in. eduction in the depth of shipping car- ons for fluorescent lamp fixtures. These artons normally run from 50 to 52 in. n length and their widths vary around to 4 in., according to the number and haracter of fixture units inclosed. A tudy of this packaging showed that the epth could be cut as above indicated ithout reducing the capacity of the car- ons. On the average the reduction to 6½ in. depth means from 29 sq. ft. per package to 21 sq. ft. Handling and toring of packages is much facilitated by this change.

•

Adds to Sales Force

The Foxboro Co. has announced the addition of Paul Torre to the staff of sales engineers covering the New Eng- land territory. His headquarters will be at the New England district office of The Foxboro Co. at Foxboro, Mass.

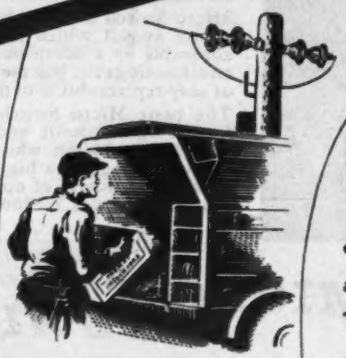
•

Expands Western Office

For more efficient handling of the ever-increasing ventilation business on the West Coast, Ilg Electric Ventilat- ing Co., Chicago, has moved its San Francisco branch office to larger head- quarters at 826 Sharon Building, 55 New Montgomery St., San Francisco 5, Calif. James S. Rose, formerly super- visory methods engineer in charge of heating and ventilation, Curtiss-Wright Co., Buffalo, N. Y., has been made manager of the new branch office.

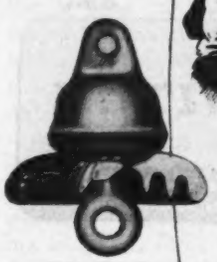
From Warehouse to Pole
NO RATTLE BREAK or ROLL

• Thomas "Pakt-To-Stack" cartons save space in your storeroom, may be stacked easily and safely. Each is legibly marked for quick identification and safely sealed against contamination.



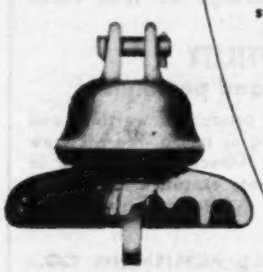
THOMAS INSULATORS

• Here's a strong new carton designed especially for Thomas 6" and 7½" diameter strain insulators. This carton is now our standard package for all units except hook-stud. Users have found there's real economy in buying their porcelain insulator requirements this "Pakt-To-Stack" way. The carton itself is light in weight, but rigid, strong and durable, guaranteeing safer and speedier handling with no breakage—all of which means lower construction costs when you specify "Thomas."

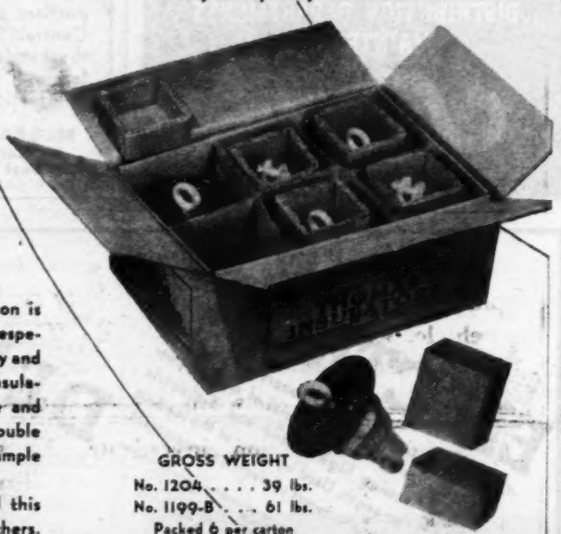


No. 1204
10,000 lb. M. & E. Rating
6" "Standard" Design

• Thomas "Pakt-To-Stack" cartons assure quicker delivery to construction crews by simplifying handling. Linemen like the lighter weight carton, find it withstands extremely rough handling and speeds construction.



No. 1199-B
15,000 lb. M. & E. Rating
7½" "Standard" Design



• The Thomas "Pakt-To-Stack" carton is made of strong fibreboard and is especially designed for maximum durability and protection to the insulator. Each insulator unit fits snugly into a separate and heavy fibreboard compartment. Double sides to the carton afford more than ample protection assuring safe delivery. Thomas Porcelain Insulators packed this modern way cost you no more than others.

GROSS WEIGHT
No. 1204 . . . . 39 lbs.
No. 1199-B . . . . 61 lbs.
Packed 6 per carton

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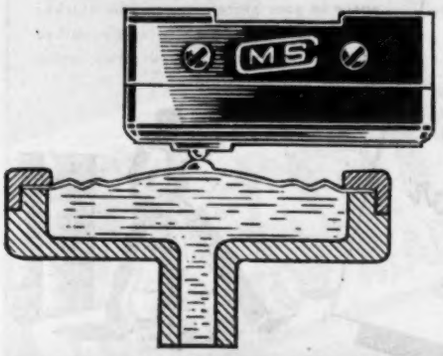

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Time . . . Temperature . . . Pressure . . . Weight

Utility engineers have found in Micro Switch the precise electrical control for many exacting applications. Built into tiny space Micro Switch has the capacity to switch up to 1200 volt amperes at line potentials from 125 to 460 volts, A. C. Each Micro Switch can be counted on for a million or more accurate operations.

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operations and personnel

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An extremely hard board of superior quality which can replace the more expensive types of insulating materials.

Pulp Products Department
WEST VIRGINIA PULP & PAPER COMPANY

REA Announces New Allotments

The Rural Electrification Administration recently approved loan allotments totaling $1,684,000 to 15 rural cooperatives in six states. These funds, which bring REA allotments to $504,910,301, of which $6,030,000 represents operations during the current fiscal year, will be used chiefly for the extension of electric service to farms which can make a substantial contribution to the food production program. No construction will be undertaken which does not meet with the approval of the War Production Board.

Unless otherwise noted, the loans listed below will provide for farmstead connections.

IOWA—Federated Cooperated Power Assn., Hampton, $200,000 for construction of generating plant; Eastern Iowa Light & Power Cooperative, Davenport, $150,000; Grundy County Rural Electric Cooperative, Grundy Center, $50,000; Marshall County Rural Electric Cooperative, Marshalltown, $45,000.

MINNESOTA—Dakota County Electric Cooperative, Farmington, $100,000 for farm connections and installation of substation equipment; Wells Electric Assn., Wells, $25,000.

MISSOURI—Lewis County Rural Electric Cooperative Assn., Monticello, $250,000; Nodaway Worth Electric Cooperative, Inc., Maryville, $155,000; Farmers' Electric Cooperative, Chillicothe, $125,000; Macon Electric Cooperative, Macon, $120,000; West-Central Electric Cooperative, Inc., Higginsville, $120,000; Ozark Electric Cooperative, Mount Vernon, $85,000.

NEW YORK—Otsego Electric Cooperative, Inc., Hartwick, $70,000.

OKLAHOMA—Caddo Electric Cooperative, Binger, $158,000.

SOUTH CAROLINA—Aiken Electric Cooperative, Inc., Aiken, $31,000 for construction of refrigerated locker plant with slaughtering and food processing facilities.

Crosley Appoints 3 Agents

The appointment of three distributors has been announced by the Crosley Corp. of Cincinnati. The Richardson-Wayland Electrical Corp. of Roanoke, Va., will serve the Central Virginia territory; Lehigh Valley Distributors of Hazleton, the northeastern part of Pennsylvania; and the Dorrance Supply Co. of Youngstown, the northeastern part of Ohio and the central western part of Pennsylvania.

"Futurliter" Returns

Edwin F. Guth Co., St. Louis, has announced that relaxation of weight-limitations by WPB, has made possible the return of FUTURLITER, the fluorescent luminaire, and deliveries can be made immediately.

SAFETY POUCH
FOR SMALL PARTS

A small parts bag for holding such items as tools, wood and lag screws, small hardware and parts to be assembled.

Keeps parts in easy reach and speeds up the job.

For line work it is worn attached to the body belt; general operations over the trouser belt.

Manufactured of medium weight canvas with web strap loops through which belt is inserted. Mouth of pouch reinforced with cloth covered rope to hold it open.

Style EW-94—8" wide; 9½" deep.

WRITE FOR CATALOG OF PRODUCTS FOR THE ELECTRICAL INDUSTRY

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Safety Equipment for all Industries
INDUSTRIAL PRODUCTS COMPANY
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ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

LETTERS TO THE EDITOR

Large Outdoor Foot—Candle Meters Suggested

To the Editor of ELECTRICAL WORLD:

Every home accepts a thermometer as a necessity; all understand degrees temperature. Who besides members of the lighting industry understand the meaning of the term foot-candle? Even in the lighting industry you frequently meet people who speak of candlepower when they mean foot-candles.

This term should be popularized and it has many possibilities for doing so. In order to sell foot-candle meters like thermometers, we must first establish a need for such a meter and a desire to own such a device. This will take a tremendous amount of effort and time. Why not begin from an entirely different angle and sell the idea in the same manner that Waltham and Bulova and Elgin sell their huge building clocks? Perhaps the management of our large skyscrapers would be willing to install large foot-candle meters, the same as clocks, for reasons of publicity. The public would soon notice and read these foot-candle meter clock faces and become interested in how the needle fluctuates as clouds pass by or the differences between summer and winter readings or sunshiny and rainy days.

After an advertising period like this, it should not be much of a trick to popularize a home meter. The public themselves would learn how these meters operate and use them at home and to their surprise see the differences between what they noticed at noon, outdoors, and indoors at night.

In this way there would be created a natural demand for foot-candle meters. A foot-candle meter in homes, offices and factories would be the best inside salesmen for more and better lighting.

CARL W. ZERSEN, Manager,
Chicago Lighting Institute.

Nevada Was Not Snubbed

To the Editor of ELECTRICAL WORLD:

The story appearing on page 7 of the WORLD for July 29, 1944, with the title "6 States Meet to Push Mexican Treaty" contains a serious misstatement—that these states were "snubbing" Nevada.

On May 8, 1944, the writer addressed

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Meter Test Switches
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For testing, disconnecting, and calibrating meters, instruments and relays.

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1304 St. Paul Street Baltimore 2, Md.

to A. M. Smith, State Engineer of Nevada, a letter quoting an AP story that Nevada would oppose the Mexican treaty and expressing to Mr. Smith his regret at this news. On May 16, 1944, Mr. Smith replied that he was "Sorry we don't see eye to eye on the Mexican treaty situation—" and went on to detail the same views in opposition to the treaty as are held by its enemies.

It seems to be some sort of crime for those who believe in this treaty to act in its favor and against the vociferous minority group of treaty opponents who are doing everything they can contrive against it. But it is submitted that after such a statement from the State Engineer of Nevada the friends of the treaty could only suppose that Nevada men would not be interested in, nor in sympathy with, the meeting of treaty proponents.

You may have remarked that treaty proponents have not chosen to try this matter in the public press. Public discussion of so complicated a matter can only be garbled by lack of necessary historical background, by many statements that are at best but half-truths and by appeals to prejudice. The matter, of real international gravity, will be tried where it should be, in hearings of the Foreign Relations Committee of the United States Senate. It will then appear that all states affected had the hearty and careful cooperation of the Department of State for over two years in an effort to secure, in the treaty, what the majority interest in the United States wanted. The treaty provisions come within the limits set by the majority and the vociferous minority was not foreclosed from a full and repeated presentation of its position.

Fair treatment of this matter, all that its proponents want, would require space for detailed history and background, which, it is not supposed is, in these times, available in either the public or technical press. Without such basic information any statements, pro or con, are almost certain not to be understandable or to be misinterpreted.

F. C. MERRIELL, Secretary,
The Colorado River
Water Conservation Dist.,
Grand Junction, Colo.

Returns Under New Title

On September 1, a Western Electric Co. publication well-known to the radio industry before the war as "Pick-Ups" once again makes its bow under the new title, "The Western Electric Oscillator." The publication presents 36 pages of technical and allied information of interest to broadcasting and electronic people. The editor is Will Whitmore with Vance Hilliard, assistant.

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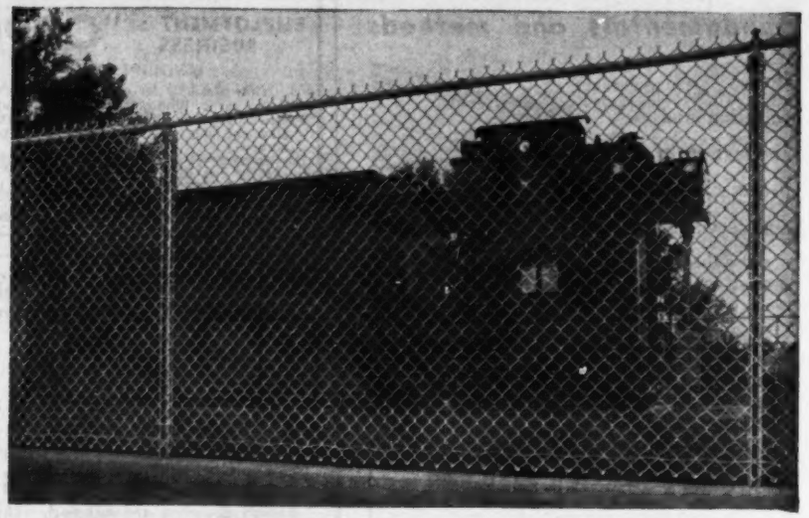

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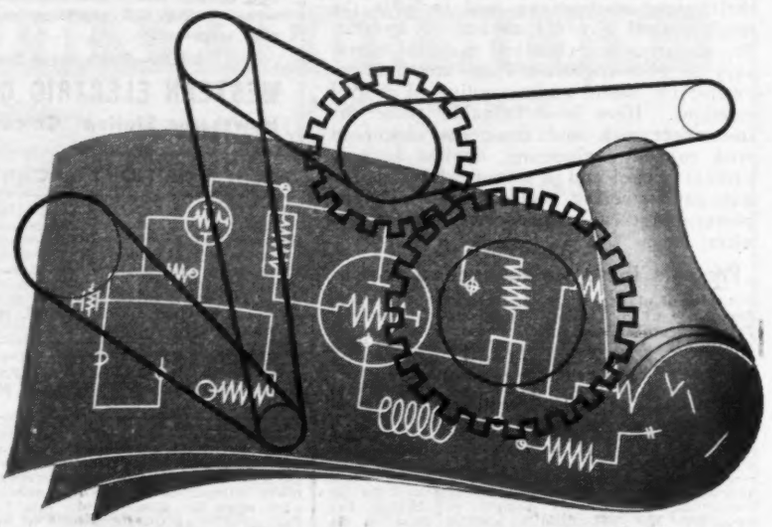
● For many electrical properties, fence protection is an essential safeguard against injuries, damages and losses. If you need this security and have proper priorities you can have a sturdy Page Chain Link Fence. Consult the Page Fence engineers and erectors near you about all fence needs, including new fencing, erecting, repairs and moving. No obligation for data and cost estimates. Write for FENCE FACTS and we will also send name of Association member nearest you. Address PAGE FENCE ASSOCIATION, Headquarters: Monessen, Pa.

PRODUCT OF PAGE STEEL & WIRE DIVISION—AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONN.



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Doolittle Engineers are still designing and producing radio equipment for the *Naval Aircraft Factory* and the *Bureau of Aeronautics.* Before the war began, "Specialized Communications Equipment" by DOOLITTLE was a consistent aid to aviation, broadcast and police radio engineers . . . Come tomorrow, our pre-war and war-born experience will be translated into many new benefits for a world of peacetime communications . . . *Look Ahead with DOOLITTLE!*

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NOW a recognized authority has gathered into a convenient volume the fundamentals, technique and data for a complete guide to this specialized field. The book gives both a qualitative and quantitative approach to meters and controllers and their plant applications, and includes the mathematical, physical, mechanical, hydraulic, acoustic, and electrical material necessary to give engineers from any field an extensively useful understanding of control relations. Here is a valuable guide for instrument men and engineers concerned with control engineering, applied both in process control and in servomechanisms for automatic steering regulation of airplane power plants and accessories, combat devices, etc.

Presents these widely-needed tools:

—tables of plants, their regulators, and the performance of controlled systems formed by different combinations. Covers many cases ordinarily met with in control engineering, giving the reader a perspective that he only could get otherwise in years of experience

—the most efficient method of handling second and third order differential equations, and cubics

—full development of the use of differential equations as symptoms with determinant tests for stability

—a flexible method of attack, showing what must be done to the plant itself for it to be controllable, how to design regulators for specified but yet-unbuilt plants, how to fit regulators to existing plants working back from response curves.

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Electrical or Mechanical Engineer

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P-740, Electrical World, 520 N. Michigan Avenue, Chicago, 11, Ill.

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WANTED: Designing Engineer experienced in electrical conduit fittings. Give all details. P-741, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

METER MAN and line foreman: Municipal utility in eastern South Dakota town of 11,000. Permanent position for qualified and experienced meter and transformer maintenance man. Opportunity for advancement. Position also open for distribution line foreman. Give full details of qualifications in first letter and salary expected. P-742, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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SALARIED POSITIONS — This advertising service of 34 years' recognized standing negotiates for high salaried supervisory technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission's. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

ENGINEER, 43, married, degree, private and public electric utility experience in design, construction, and management. Desires management position with utility or engineering with manufacturer with minimum travel. Salary $6,000 minimum. PW-726, Electrical World, 330 W. 42nd St., New York 18, N. Y.

POSITIONS WANTED

ELECTRICAL SUPERINTENDENT, 25 years utility experience; transmission, distribution and substation construction supervision; property accounting; estimating, etc. Desires supervisory position with utility requiring good employee relations. Am now employed. 2 weeks necessary. Past draft age. PW-730, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ENGINEER thirty years experience in design, construction and operation of generating plants, substations and transmission systems in utility and industrial field. Position with postwar future only considered, go anywhere. PW-731, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ASST. SALES mgr. Technically-trained sales executive (Cornell ME) 15 years experience lamp and lighting fixture field (mfgr. and jobber) including 4 years as lighting director utility Co., desires post-war position with progressive electrical firm assisting sales mgr. marketing new products, planning sales campaigns, training salesmen, etc. Knows production methods; some knowledge electronics. Excellent health, good appearance and personality; able to think and act aggressively; cooperate fully with associates. Age 48. Interview Chicago. PW-743, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

Don't forget the

BOX NUMBER

When answering the classified advertisements in this magazine, don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

POWER FOR PRODUCTION

MOTORS GENERATOR SETS

1—750 KW, 250 volts, Allis-Chalmers, synchronous.
2—150 KW, 125 volt, Westinghouse, synchronous.
1—75 KW, 125 volt, General Electric, squirrel cage.
1—15 KW, 250 volt General Electric, squirrel cage.
1—6½ KW, 125 volt, General Electric, squirrel cage.

MOTORS—3 PHASE 60 CYCLE

1—250 HP, 300 RPM, 440 volt, G.E., slip ring.
1—300 HP, 720 RPM, 2200 volt, G.E. Sl. Rg.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—250 HP, 600 RPM, 2200 volts, G.E. slip ring
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volt, General Electric, squirrel cage.
2—150 HP, 1200 RPM, 2300 volt, Westinghouse, squirrel cage.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 600 RPM, 440 volt, General Electric, squirrel cage.
1—500 HP, 900 RPM, 440 volt, Lincoln, sl. rg.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
1—145 HP, 600 RPM, 220 volt, General Electric, synchronous
1—125 KVA, 900 RPM Westinghouse, synchronous
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1— 90 HP, 400 RPM, 550 volt, Cr. Whlr. sq.cg.
1— 75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1— 75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1— 75 HP, 720 RPM, 440 volt, G.E., sq. cg.
1— 50 HP, 900 RPM, 440 volt, G.E., slip ring.
1— 50 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—200 HP, 440 volt, 600 RPM, Crocker-Wheeler, slip ring.

MOTORS—D.C. 230 VOLTS

2—450 HP, 400 RPM, G.E.
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
2—150 HP, 400/550 RPM, Westinghouse, type SK
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1— 50 HP, 750 RPM, Westinghouse, type SK.
1— 50 HP, 700 RPM, Crocker Wheeler.
1— 40 HP, 775 RPM, Westinghouse.

TRANSFORMERS

4—3000 KVA, General Electric, 14000, with taps, 2400/4150Y.
2— 400 KVA, G.E., 4156-240/480 v., Scott taps.
3— 300 KVA, Pittsburgh, 7800/440 volts.
3— 150 KVA, G.E., 33,000 2300/4000 Y.
3— 150 KVA General Electric, 2400/240/480 volts.
3— 100 KVA, Westinghouse, 11,430/250 volts.
1— 100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3— 100 KVA, Westinghouse, 13200 250 volts.
3— 100 KVA, General Electric, 2200-220/110 volts.
3— 75 KVA, G.E., 13,500-7500/440 volts.
3— 75 KVA, G.E., 2200/220/110 volts.
1— 75 KVA, G.E., 2400/4800/120/240 volts.
1— 75 KVA, G.E., 3 phase, 4156Y-120/208Y.
3— 50 KVA, General Electric, 2200/220/110
2— 50 KVA, Phgh., 7500/15,000 volts-110/220 volts.
3—37½ KVA, General Electric, 2200/220/440.
2— 30 KVA, Allis Chalmers, 3 phase, 4156Y/120/208Y.
1— 25 KVA, G.E., 220/110-220/110 volts.
2— 15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

1— 90 HP, 470/940 RPM, General Electric.
1— 75 HP, 525/1575 RPM, Electro Dynamic.
1— 35 HP, 500/1500 RPM, Westinghouse.
1— 30 HP, 225/900 RPM, Crocker Wheeler.
1— 30 HP, 400/1200 RPM, General Electric.
2— 25 HP, 300/990 RPM, Electro Dynamic.
1— 20 HP, 750/1500 RPM, General Electric.
1— 15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
2—11½ HP, 500/1500 RPM, Westinghouse, type SK.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

INSTRUMENTS

25—Westinghouse type U recording ammeters with split core CT.
25—Westinghouse type U recording voltmeters.

TURBO GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

J. L. HEMPHILL & CO., INC., Power Equipment

New York Phone: LOngacre 5-3227 — 1602 53rd ST., NORTH BERGEN, N. J. — New Jersey Phone: UNion 3-2600

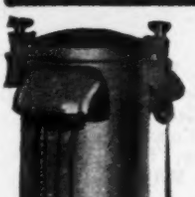
G E Motor D.C. Type RT-Comp. wound 2.4 amps-550 volts-1.50 H.P. Speed 1475

Diehl Motor-D.C. Frame L-12 Comp. wound 12.2 amps-500 volts-Full load R.P.M. 1050/1680 output 7½ H.P. cont. 50°C. Rise.

Diehl Control Panel—500 volts 5½ H.P. 13 AMP including Trumbull Safety switch of 30 amp. 600 volts 3 pole.

TOPPING HOUSE
166 Terrace St. Roxbury 20, Mass.
Tel. Highlands 2866

—TRANSFORMERS—



BOUGHT and SOLD

We have several thousand transformers in stock for prompt shipment, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M — Since 1912 — CINCINNATI 27, OHIO

READY TO BUY
Industrial Plants

Our organization has specialized on purchase and disposal of large industrial plants for more than 30 years. Owners of properties have received successful results. We are NOT auctioneers or brokers.

Correspondence Invited

BROWN-STRAUSS CORP.
1402-1720 Guinotte, Kansas City 10, Mo.
Established 1908

Rotary Converters—3 Ph. 60 Cy.

K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
1—1500	Whse.	720	650	11500
1—1250	G.E.	720	250	4300
1—1000	Whse.	600	250	22000
1—1000	Whse.	900	600	2300
2— 750	Whse.	1200	600	2300/4000

Rotary Converters—3 Ph. 25 Cy.

2—1500	G.E.	500	225/275	6600
1— 500	G.E.	750	225/275	6600

M. G. Sets—3 Ph. 60 Cy.

1—1500	G.E.	360	275	2300/4600
1—1000	G.E.	720	250	2300/4150
1— 500	G.E.	600	250	440/2300
1— 500	G.E.	720	600	13200
1— 400	G.E.	720	250	2300

BELYEA COMPANY, INC.
51 Howell Street, Jersey City, N. J.

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

BREW, WOLTMAN & CO.
52 Church St., New York 7, N. Y.

New "SEARCHLIGHT" Advertisements

received by 10 A. M. Monday will appear in Saturday's issue, subject to space limitations.

Departmental Staff
ELECTRICAL WORLD
330 West 42nd St., New York City

60-TON LOCOMOTIVE

Storage Battery Type, built by General Electric Co. in 1930. Double truck, 4-motor type, each 75 H.P. Steeple cab. Good condition.

Complete specifications available.

IRON & STEEL PRODUCTS, INC.
13438 S. Brainard Ave., Chicago 33, Ill.
"ANYTHING containing IRON or STEEL"

DIESELS

ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y
Phone Roslyn 1220

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SAVE TIME

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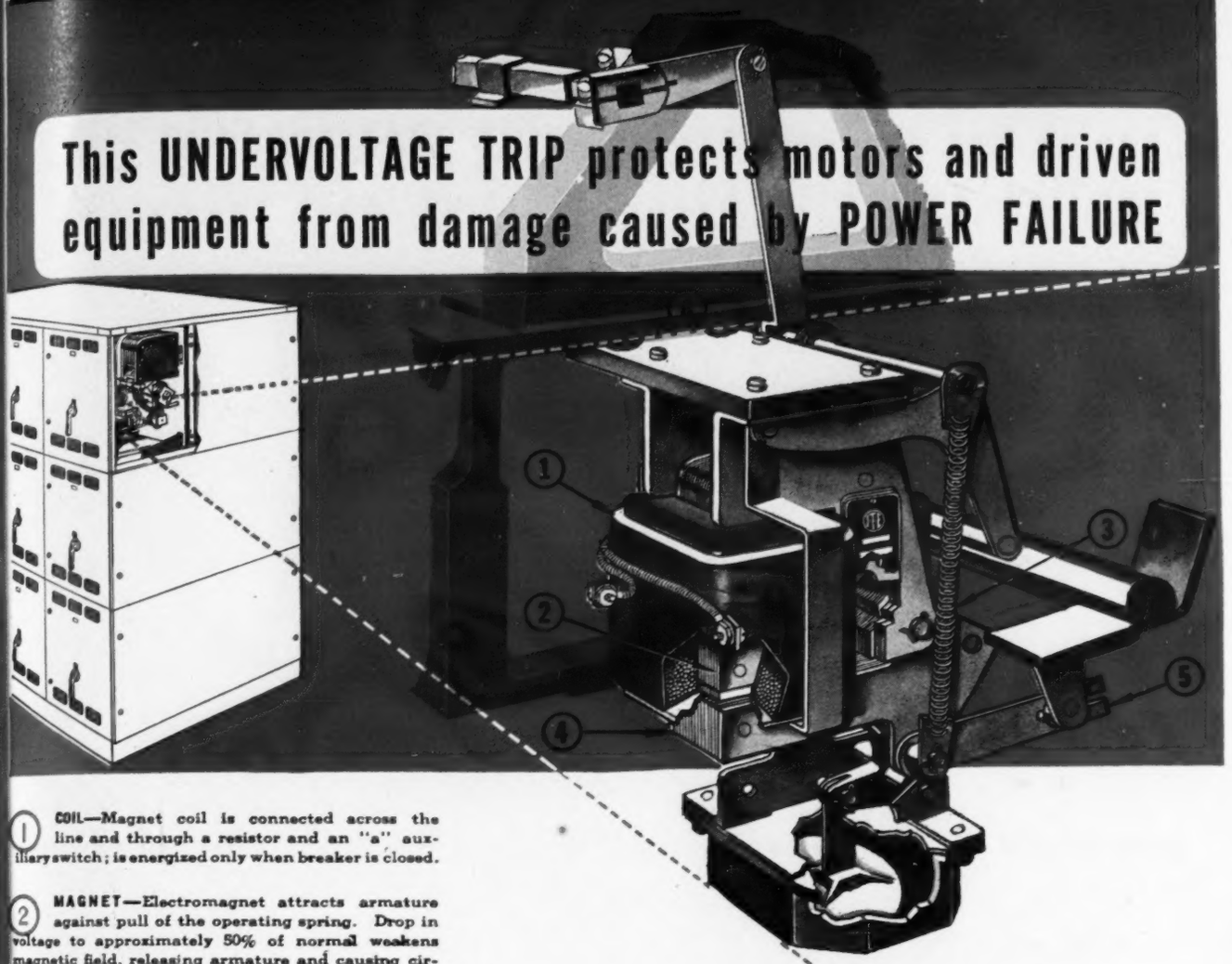
★ **These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

Features of I-T-E DRAWOUT SWITCHGEAR

This UNDERVOLTAGE TRIP protects motors and driven equipment from damage caused by POWER FAILURE



1. **COIL**—Magnet coil is connected across the line and through a resistor and an "a" auxiliary switch; is energized only when breaker is closed.

2. **MAGNET**—Electromagnet attracts armature against pull of the operating spring. Drop in voltage to approximately 50% of normal weakens magnetic field, releasing armature and causing circuit breaker to open.

3. **OPERATING SPRING**—When circuit breaker is open, spring holds armature against faces of magnet poles. When circuit breaker is closed a change in position of the linkage makes spring tend to pull armature away. Magnet resists this action.

4. **ARMATURE**—Attracted by magnet against the pull of the operating spring when circuit breaker is closed. Release of armature opens breaker through link to tripper bar.

5. **LINK TO TRIPPER BAR**—Transmits movement of armature to trip mechanism that opens breaker when pull of operating spring overcomes attraction of magnet because of undervoltage condition.

6. **SPRING ARM LINK**—Attached to circuit breaker mechanism at upper end. Releases linkage so that operating spring holds armature against pole faces of magnet when breaker is open. When breaker is closed, it sets arm so that spring tends to pull armature away from pole faces.

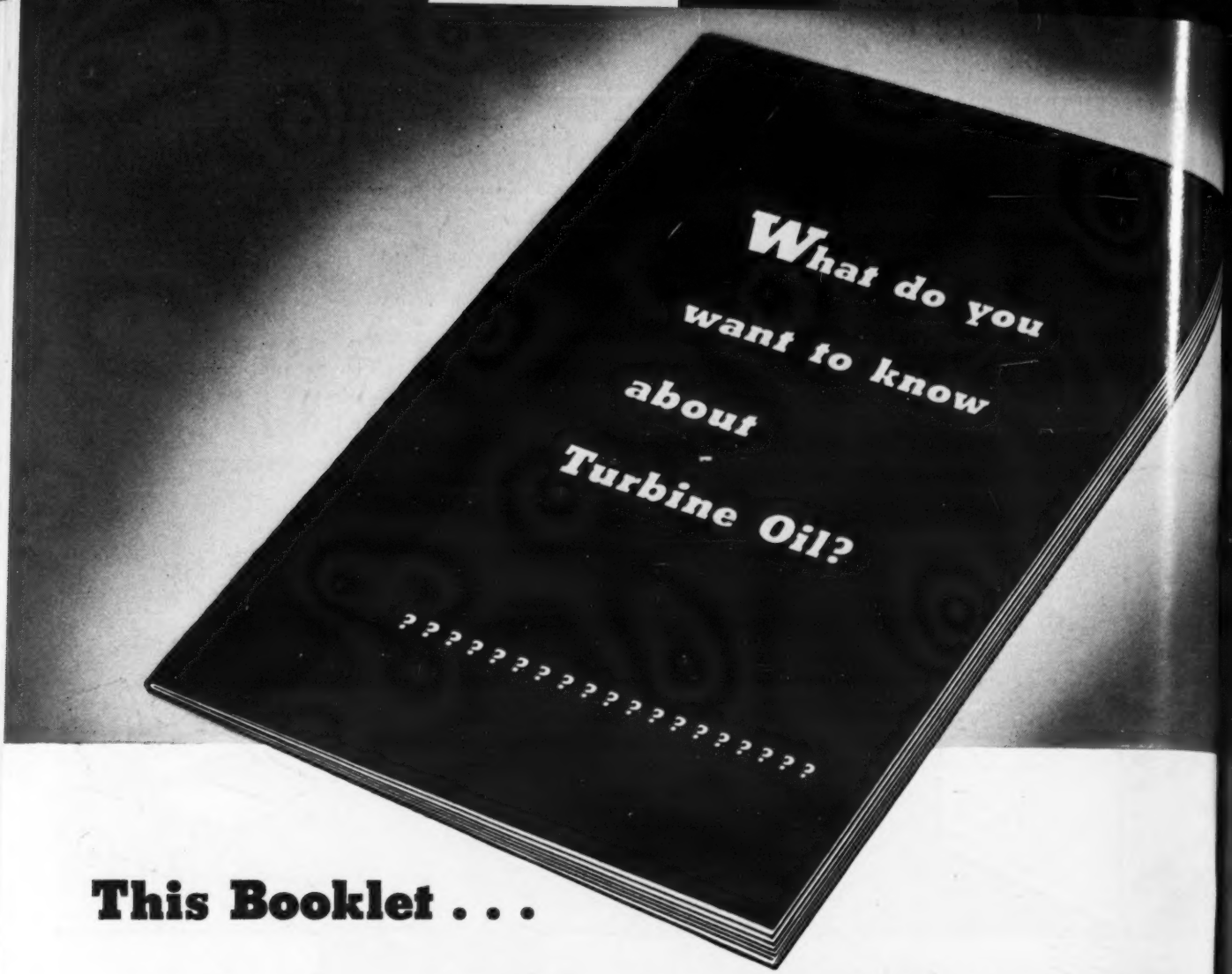
Hazards arising from power failure are well known to operating men. The unexpected slowing or stopping of motor drives followed by equally unforeseen resumption of full speed can give rise to conditions damaging for d-c armatures and a-c windings, can do harm to machining and processing equipment, can injure workmen.

Protection against "undervoltage" is simple in principle. A drop to a predetermined, critical value causes a magnet to release an armature and the breaker opens. From that point, there need be no damaging current or unforeseen resumption of power or load.

Simple as this is, what you want on the part of the undervoltage trip is positive, dependable action. This I-T-E gives you—and we will gladly tell you about it to the last detail. Just call the nearest I-T-E representative or write to I-T-E Circuit Breaker Co., 19th and Hamilton Streets, Philadelphia 30, Pa.

Representatives in Principal Cities

I-T-E AIR SWITCHGEAR



This Booklet . . .

answers many questions about turbine operation

Such as:

1. What causes turbine oil deposits or sludge?
2. What causes acidity increase in turbine oil?
3. What is an oxidation inhibitor—how does it prevent acidity?
4. How does a guaranteed turbine oil protect the user?
5. Does the inhibitor in Nonpareil Turbine Oil wear out?
6. What causes corrosion in turbines?

Gasoline Powers the Attack . . . Don't Waste a Drop!

Send for a copy

or copies of this book for anyone in your organization who is concerned with specifying or buying turbine oil, or in charge of turbine operation. It explains significant facts about turbine lubrication and clarifies much of the confusion which seems to exist regarding them. Better still, send for a Standard Oil Lubrication Engineer who can answer your specific questions. Write Standard Oil Company (Indiana), Room 1223, 910 South Michigan Avenue, Chicago 80, Illinois, for a copy of the booklet, or the Engineer nearest you.

NONPAREIL TURBINE OIL

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING